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Personnel

INFORMATION FOR DESIGNERS OF INSTRUCTIONAL SYSTEMS

APPLICATION TO TECHNICAL TRAINING

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This volume provides information and guidance for applying the Instructional System Development (ISD) process described in AFMAN 36-2234. This handbook is a guide for Air Force personnel who plan, design, approve, administer, or manage Air Force technical training. It is designed for use as needed in technical training. Although several additional references are listed, this handbook is intended for use alone without any requirements to read other ISD handbooks. Each handbook is developed for a particular community and has the appropriate language and applications to support it. You are not required to read this handbook from cover to cover but may enter it at any desired phase of instruction where information is available to resolve your problem. You may use this handbook to design or revise a curriculum, a course, or any isolated aspect of it.

Chapter 1
GENERAL INFORMATION

Overview

Introduction

This handbook serves as a guide for applying the Instructional System Development (ISD) process to the design, development, implementation and management of technical training in the Air Force. It adheres to the policies of AFPD 36-22 and follows the principles and procedures outlined in AFMAN 36-2234. It is intended as an easy reading guide for novices, experienced training managers, curriculum developers, and instructors. While it is designed as a "stand-alone" document, you should read and be familiar with AFPD 36-22 and AFMAN 36-2234. You should also be familiar with the training development documents referenced throughout this handbook, as applicable.

Background

In the past, the Air Force ISD manual and handbook were focused on how ISD applied to technical training. There was little or no guidance on applying the ISD process to other areas such as aircrew training, acquisition, or education. The revised AFMAN 36-2234 provides the guidance and procedures necessary for applying the ISD process throughout the Air Force, regardless of the type of training or education being developed. Various volumes of AFH 36-2235 provide specific guidance and procedures for applying ISD to aircrew training, acquisition, education, and technical training. Other volumes of AFH 36-2235 have been developed to cover applications of ISD in other areas such as computer-based training (CBT) selection and interactive courseware (ICW) decisions.

Purpose

This handbook provides specific information and guidance for using the instructional development process to develop technical training. It provides information on the ISD model, planning for ISD projects, phases of the ISD process, system functions, and quality improvements.

Is this handbook for you?

This handbook addresses the question: "How do you apply the ISD process in technical training?" It is applicable whether a contractor or the Air Force develops the training. But is it for you?

Are You Responsible For . . .	**Yes**	**No**
Developing specialty training?		
Using Occupational Survey Report (OSR) data to develop training for an Air Force Specialty (AFS)?		
Developing courseware to train personnel to maintain equipment at organizational, intermediate, or depot level?		
Are You . . .	**Yes**	**No**
A training manager, curriculum developer, training specialist or instructor with a few years' experience in ISD?		
A Subject Matter Expert (SME) with no ISD experience?		
An ISD expert?		
A novice or "entry-level" curriculum developer?		

If you checked **YES** to any of these questions, this handbook will help you do your job.

What is ISD?

ISD is a systematic but flexible process used to analyze, design, develop and implement training in an effective and cost-efficient manner. It is a total quality process that continuously strives to improve the system (continuous evaluation). ISD ensures that:

There is a training need.
There is an effective and efficient solution to the need.
The solution can be implemented.
The solution can be assessed to determine whether it meets the need.
Continuous quality improvements are made throughout the ISD process.

Basis for ISD

The ISD process used in the Air Force is based on:

Basic research on how people learn.
Basic research on how people communicate.
The systems engineering process.
The concepts of instructional technology.

Why use ISD?

Using the ISD process ensures that training is both effective and cost-efficient. ISD requires that you:

Assess the need for training.
Analyze training requirements.
Design training to meet specific job requirements that have been identified through a training needs assessment.
Design training for all job elements that are critical to successful performance.
Design training to meet specific training objectives.
Choose methods and media to optimize the effectiveness and cost-efficiency of training.
Evaluate courses to make sure they meet the objectives and revise them if they fail to do so.
Collect and use student data to improve the quality of the training.

Goal of ISD

The goal of ISD is to produce graduates who can perform their jobs after receiving training and to reduce overall costs of training by accurately identifying training requirements.

How to use ISD

ISD is:

Flexible and systematic.
A tool to get the right training for the problem.
Not a lock-step, linear process.

Don't have a "checklist mentality" when you're using the ISD process.

How to use this handbook

This handbook is a guide to help you develop Air Force technical training courses. Use this handbook by thinking about your specific assignment and use the information in this handbook to develop training. The following questionnaire will assist you in identifying the sections you need to read.

Do You Have To . . .	Yes	No	Page
Determine the workforce needs of the system?			49
Determine the training required to meet system needs?			49
Determine overall training system requirements?			52
Determine training development management strategies?			59
Determine ISD evaluation requirements?			61
Conduct occupational/job analysis?			69
Conduct task analysis?			73
Conduct learning analysis?			87
Analyze resource requirements / constraints?			94
Develop training plans?			100
Develop objectives?			109
Develop tests?			124
Review existing materials?			141
Design training?			145
Design training information management systems?			166
Finalize training materials?			209
Conduct training?			226
Conduct evaluations?			233
Design training?			145
Design training information management systems?			166
Finalize training materials?			209
Conduct training?			226
Conduct evaluations?			233

Chapter 2
INSTRUCTIONAL SYSTEM DEVELOPMENT MODEL

Overview

Introduction

Designing, developing, delivering and supporting a training system requires considerable time and effort on the part of managers and curriculum developers. Curriculum developers must design, develop, and implement effective and cost-efficient training, while managers must control, coordinate, and integrate the training into a total training system using the principles of Quality Improvement (QI). A total instructional system model includes the phases of ISD, the system functions, and the QI process. This chapter will address these areas.

Objectives

The objectives of this chapter are to:

Define the phases of the ISD process.
Discuss the system functions.
Explain the QI process.

Updated Air Force ISD model

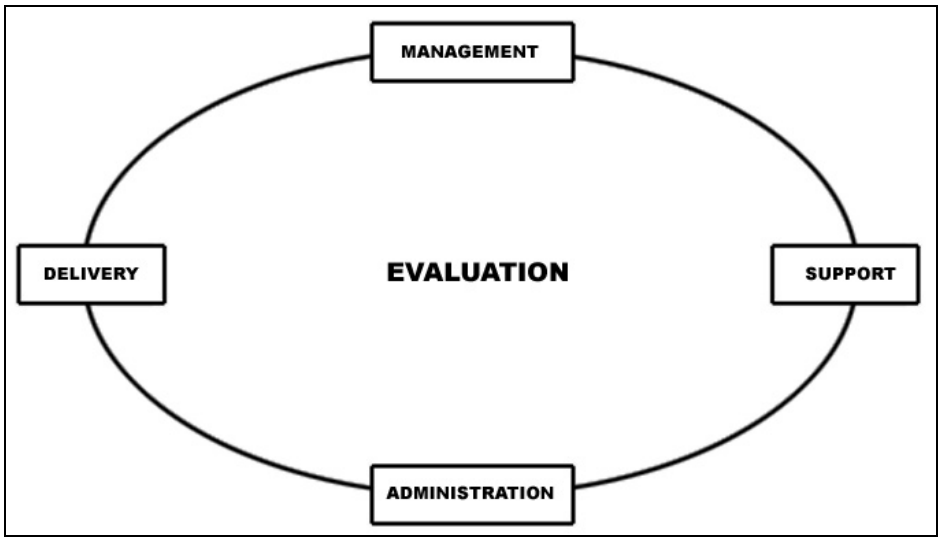
The updated ISD model has been designed to represent simplicity and flexibility so that instructional developers with varying levels of expertise can understand the model and use it to develop effective, cost-efficient instructional systems. The model also depicts the flexibility that instructional developers have to enter or reenter the various stages of the process as necessary. The nature and scope of the development, update, or revision effort determine the entry or reentry into a particular stage of the process.

System functions

An extension of the systems approach places the ISD process within the functional design of a total instructional system. Figure 1 shows the basic top-level system functions of the instructional system: management, support, administration, delivery, and evaluation.

System functions (Continued)

Figure 1 System Functions



What are they?

The system functions of the ISD model are:

Management: the function of directing or controlling instructional system development and operations.

Support: the function of maintaining all parts of the system.

Administration: the function of day-to-day processing and record keeping.

Delivery: the function of bringing instruction to students.

Evaluation: the function of gathering feedback data through formative, summative, and operational evaluations to assess system and student performance.

Relation to ISD

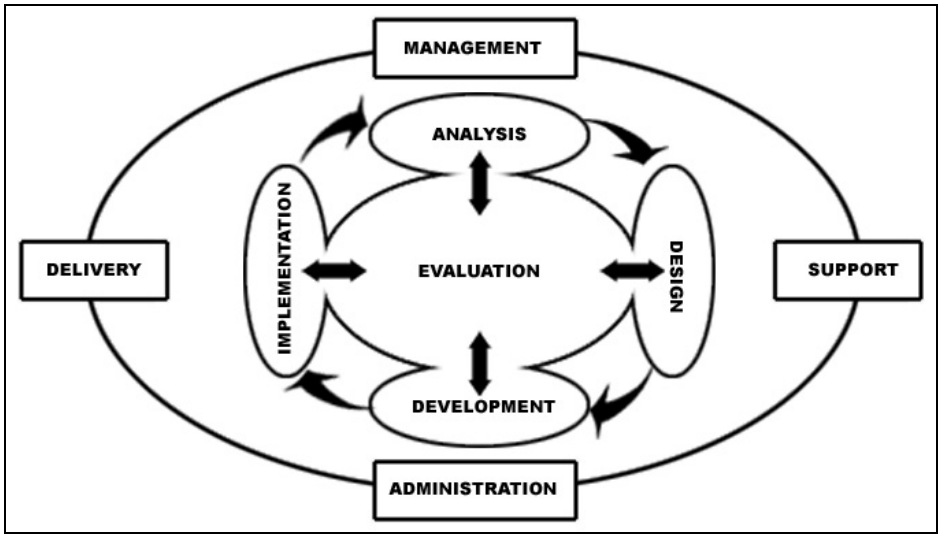
Using these essential functions to design the overall instructional system architecture and then allocating them to the respective instructional system components or people responsible, ensures that these functions are operational when the total training system is fielded. ISD products are integrated into the total

Relation to ISD (Continued)

instructional system, and aspects of the system functions are active throughout all phases of the ISD process.

Figure 2 shows the phases most often used in the systems approach, which are analysis, design, development, and implementation, with evaluation activities integrated into each phase of the process. The phases are embedded within the system functions. Evaluation is shown as the central feedback "network" for the total system.

Figure 2 Functions with Phases



The instructional development process, which the model summarizes, calls for instructional developers to:

Analyze and determine what instruction is needed.
Design instruction to meet the need.
Develop instructional materials to support system requirements.
Implement the instructional system.
Evaluation is a central function that takes place at every phase.

Relation to ISD (Continued)

Symbolically, Figure 2 shows that all phases of the model depend on each of the other phases. The ISD process allows the instructional developer or design team to enter or reenter the various phases of the process as determined by the nature and scope of the development or revision activity. The phases of the updated model are described below.

Analysis phase

In courses that tie the content directly to preparing a student to do a job, the instructional developer analyzes the job performance requirements and develops a task list. This helps ensure that the customer's needs are being met. The developer then analyzes the job tasks and compares them with the skills, knowledge, and abilities of the incoming students. The difference between what they already know and can do and what the job requires them to know and be able to do determines what instruction is necessary.

Design phase

In the design phase, the instructional developer develops a detailed plan of instruction that includes selecting the instructional methods and media, and determining the instructional strategies. Existing instructional materials are reviewed during this phase to determine their applicability to the specific instruction under development. In this phase, the instructional developers also develop the instructional objectives and test and design the instruction. The implementation plan for the instructional system is also developed in this phase and a training information management system is designed, if required. Formative evaluation activities continue in this phase.

Development phase

In the development phase, both the student and instructor lesson materials are developed. If the media selected in the design phase included items such as videotapes, sound/slides, interactive courseware (ICW), and training devices, these are developed. If a training information management system was developed for the instructional system, it is installed in this phase. As a final step in this phase, the implementation plan is updated. During this phase, instructional developers also validate each unit/module of instruction and its associated instructional

Development phase (Continued)

materials. They correct any deficiencies that may be identified. Validation includes:

Internal review of the instruction and materials for accuracy.
Individual and small-group tryouts.
Operational tryouts of the "whole" system.

Revision of units/modules occurs as they are validated, based on feedback from formative and summative evaluation activities. The final step in this phase is to finalize all training materials.

Implementation phase

The instructional system has been designed and developed, and it is now time for the actual system to become operational. In this phase, the instructional system is fielded under operational conditions and the activities of operational evaluation provide feedback from the field on the graduate's performance.

Evaluation

Evaluation is a continuous process beginning during the analysis phase and continuing throughout the life cycle of the instructional system. Evaluation consists of:

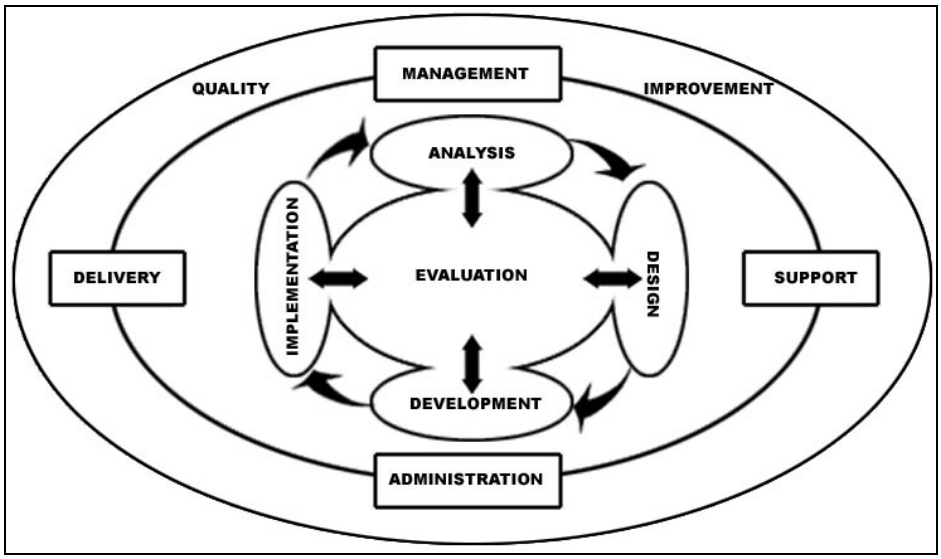
Formative Evaluation, consisting of process and product evaluations conducted during the analysis and design phases, and validation that is conducted during the development phase. Included are individual and small group tryouts.
Summative Evaluation, consisting of operational tryouts conducted as the last step of validation in the development phase.
Operational Evaluation, consisting of periodic internal and external evaluation of the operational system during the implementation phase.

Each form of evaluation should be used during development, update, and revision of instruction, if possible, and if the form of evaluation is applicable.

Updated AF ISD model

Figure 3 depicts the completed ISD model. This completed figure shows the system functions and ISD phases embedded within the quality improvement (QI) process.

Figure 3 Updated AF ISD Model



The QI process, which is further discussed in this chapter, is briefly described below.

Quality improvement is the continuous, organized creation of beneficial change to the system. The objective of quality improvement is to foster continuous improvement in the process and products of ISD. It is an independent evaluation to determine whether the products are meeting the users' needs. The objective of quality improvement is to ensure on-time development of high-quality courseware that enables students to reach the desired performance levels in an effective and cost-efficient manner.

The updated model graphically illustrates that:

Evaluation is the foundation of the ISD process.

Updated AF ISD model (Continued)

ISD is a continuous process with the flexibility to enter and reenter the various phases, as necessary, to develop, update, or revise instruction.
All ISD activities take place within and are dependent on the system functions.

Teamwork is required between personnel performing system functions and those designing, developing, and implementing instructional systems.

All ISD activities and system functions focus on continuous quality improvements in the system.

Where to read about it

This chapter contains seven sections that provide a brief overview of the ISD process.

Section A
Total Training System Functions

What are system functions?

System functions should be in place before implementing the training system. The system functions are described below.

MANAGEMENT	The practice of directing or controlling all aspects of the training system.
SUPPORT	Provides for and maintains the training system on a day-to-day as well as long-term basis. Examples are the resources you need to keep equipment functioning.
ADMINISTRATION	The part of management that does day-to-day tasks such as documentation, student assignments, and student records.
DELIVERY	The means by which training is provided to students. Instructors, computers, printed materials, audiovisual programs are all examples of ways to deliver training.
EVALUATION	The function of gathering feedback data through formative, summative, and operational evaluations to assess system and student performance.

When do you implement them?

For the training system to be effective and cost-efficient, system functions must be working before the actual design, development and implementation processes begin.

Technical training management system support functions

The Technical Training Management System (TTMS) is intended to support almost every aspect of the training process, from analysis to evaluation. TTMS modernizes training and provides the following automated training functions:

Reduces manpower intensive processes

Eliminates Ad Hoc Databases.
Provides modernized computer-based working environment.
Provides an automated evaluation system.

Technical training management system support functions (Continued)

Standardizes courses using software tools for course
- Analysis
- Design
- Development

Improves resources productivity through automated administration of
- Training Equipment
- Employees
- Facilities

Improves learning effectiveness (minimizes student ineffectiveness)
- Automates Student Administration
- Manages student training time

ISD processes supported by TTMS

The TTMS functions support the following ISD processes:

Training Analysis, Design and Development
- Training Requirements and Task Analysis
- Analyze Target Audience
- Develop Objectives
- Select Media
- Test Development and Validation
- Build Lesson Plans, Flow Charts, and Storyboards
- Automates course control documents

Training Evaluation
- Students
- Materials
- Resources
- Instructors

Administration and Resource Management
- Scheduling of students, instructors, equipment, facilities, etc.
- Interfaces with class assignment systems
- Automated coordination, review, and editing of training documents

Section B
Analysis

What it is

During analysis, you:

Collect information on job performance requirements of Air Force specialties/jobs/tasks/duties.
Determine the necessary qualifications of the job performers.

Why do it?

You conduct analysis to make sure you get the **right training** for the stated need.

Where to read about it

Details on the analysis phase of ISD are available in Chapter 4. Specific topics are listed below.

When you do it

Conduct analysis before you begin to design and develop a new training system or revise an existing system.

What you get

If you have conducted analysis correctly, you will get valid training requirements and accurate predictions of the resource requirements.

What you need

To conduct analysis, you need to assess items such as:

Equipment
Subject matter experts
Weapon system data
Technical data
Occupational Survey Report data
Engineering data
Similar systems or programs
Performance standards

Section C
Design

What it is

Training design is like architectural design. You figure out what you want the training to look like and how you want it to work before you build it. The analysis that you previously conducted helps determine the basic structure in the design phase.

Why do it?

The purpose of design is to be sure that the product teaches. If a product does not teach it has no value. Way too much training does not teach. Supposedly a designer knows what is effective in promoting learning for different kinds of outcomes. The designer then builds into the instruction those conditions that are necessary for effective and efficient learning to occur. If these conditions are not built into the materials then there is strong likelihood that the materials will not teach.

Where to read about it

Details on the design phase of ISD are available in Chapter 5. Specific topics are listed below.

When you do it

Design the training system before you begin to develop training.

What you get

Proper design will result in:

Objectives that you will prioritize, cluster, and sequence.
Tests that measure the objectives.
Training methods, media, and strategies to deliver the training.
A training information management system.
A review of existing material.

What you need

For the ISD design phase, you need all the products you developed during initial planning and in the analysis phase.

Section D
Development

What it is

During ISD development you develop, validate, and revise the training. Development activities for technical training include:

Writing (print)
Producing (video or audiovisual materials)
Installing (management systems)
Building (devices/simulators)
Validating (formative, summative, and operational evaluation) training (instruction)
Revising (training)

Why do it?

Development is the production of the materials. Without development there is no instruction except perhaps in the case of extemporaneous live instruction. With technology production (development) has become a highly specialized area with different people needed for different aspects of the production (artists, technical writers, computer programmers, web site designer.)

Where to read about it

Details on the development phase of ISD are available in Chapter 6. Specific topics are listed below.

When you do it

Develop training after the design is completed and before the training is implemented.

What you get

Proper development results in training products that meet design specifications.

What you need

For the development phase, you need:

Analysis and design documents and products.
Students and equipment for validation.

Section E
Implementation

What it is

In the implementation phase, the training system is implemented and the course becomes operational.

Why do it?

You implement and conduct training to meet a specific need.

Where to read about it

Details on the implementation phase of ISD are available in Chapter 7. Specific topics are listed below.

When you do it

Training enters the implementation phase of ISD once it has been validated.

What you get

Successfully implemented training results in graduates who meet job performance requirements.

What you need

For the implementation phase, you need:

A finished training product.
All training system functions in place.

Section F
Evaluation

What it is

Evaluation measures the quality, effectiveness, and efficiency of the training system. Evaluation answers the questions:

Is the process effective and cost-efficient?
Are quality products being developed?
How well are the course graduates performing on the job?
How can the system be improved?

Why do it?

Evaluation improves the quality of the ISD process and products while producing graduates who can meet job performance requirements.

Where to read about it

Details on the evaluation phase of ISD are available in Chapter 8. Specific topics are listed below.

When you do it

Evaluation begins in the initial planning stages of the ISD process and continues throughout the life cycle of the system.

What you get

Evaluation provides data on the quality of the ISD process and products and determines whether graduates are meeting job performance requirements.

What you need

To properly perform evaluation, you need:

An operational plan.
Completed ISD activities.
ISD products.
An operational system.
Graduates.
An evaluator.

Section G
Quality Improvement

Introduction

ISD is a continuous, systematic process that incorporates a never-ending evaluation process. The Air Force uses the ISD process as a tool to ensure that quality instructional systems are developed. It helps managers and instructional developers design, develop, and implement quality instruction for Air Force personnel in the most effective and cost-efficient manner possible. The ISD process implements all of the principles of the Quality Air Force (QAF) program. A process-focused approach is a major way of achieving continuous, measurable improvements in the quality of the instructional development process. As you implement a structured approach for process improvements, you will be identifying problems, analyzing data, evaluating problem solutions, and working together with other members of the training design team to improve the process. This section covers Quality Improvement (QI) and explains total quality process improvement.

What it is

Quality Improvement is the continuous, organized creation of beneficial change to the system. It is an independent evaluation to determine whether the instructional products are meeting the students' needs.

Objectives of QI

The objectives of quality improvement are to foster continuous improvement in the processes and products and to ensure on-time development of high-quality courseware that enables students to reach the desired performance levels in an effective and cost-efficient manner.

Results of QI

Quality instructional product development results in:

Increased student satisfaction.
Products that are easy to use and maintain.
Increased ability of students to perform on the job.

Quality instructional design results in:

Fewer errors.
Less rework (and waste).
Higher success training.
Less time spent in development of new training products.
Lower life cycle costs.

ISD and quality relationship

All of the principles of quality are implemented in the ISD process. The ISD process ensures total quality in the training environment by continuously evaluating the process and products. The relationship between the key concepts of QI can be easily seen in the ISD process. For example:

Customers:

The customer defines quality. ISD emphasizes criterion-based training. The criteria are directly linked to performance requirements. Field representatives (supervisors, squadron commanders, etc.) identify training requirements, which training providers such as Air Education and Training Command (AETC) or other training organizations are then under "contract" to satisfy. All evaluations are focused on the trainee's actual job performance.

Know your customer. The information gained in the mission/job analysis process gives you or the training design team information that defines the customer's expectations. Since ISD requires all training to be directly tied to job requirements, the customer is the gaining unit or work center. Everything is done on the premise that what the individual needs to do the job determines the training requirements.

ISD and quality relationship (Continued)

Focus on customers. As mentioned earlier, the gaining unit or work center needs to determine training requirements. By continuing to trace the relationship between the job requirements and the individual's needs to do the job, a continual focus on the actual field requirement is maintained. In addition, the ISD process requires that the capabilities, aptitudes, and attitudes of the target audience be considered during the design phase.

Team Players:

Foster teamwork. A training program cannot be designed and developed in a vacuum. In order to develop effective, cost-efficient training, the development team should be in constant touch with the work center and evaluation offices to ensure that the training matches the performance requirements on the job.

Empower your people. ISD is a problem solving, decision-making model. Since ISD is flexible and since there are many ways to solve a given training problem, a development team should be allowed freedom and given authority to analyze, design, develop, and implement training meeting job performance requirements and standards.

Final Product:

Know your mission. ISD depends on mission and job analysis for the necessary data to design, develop, and implement training. All training must be based directly on mission or job requirements. The quality checks in the analysis process help eliminate training that is unnecessary or unrelated to the job.

Job analysis uses data from many sources, including mission statements found in policy directives or locally developed statements. Curriculum developers also make use of management engineering reports, occupational survey data, and direct observation to determine the actual job requirements.

As part of the job analysis process, a training needs assessment (TNA) is conducted to determine the actual performance problems. In some cases, a problem is not due to a lack of training, but to deficiencies within the job structure

ISD and quality relationship (Continued)

or training environment. The ISD process helps ensure that training is not developed for non-training problems. Training may also be developed as a "preventive" measure — that is, to prevent potential problems and to meet the informational and educational needs of Air Force personnel.

Set goals and standards. The goals and standards for the training design and development effort come in many variations. First, the job requirements and the impact of the performance deficiency determine the timing required for the design and development process and the conducting of the training program. Second, the content of the training is determined by the individual's need to do the job. You or the development team must directly translate the cues, conditions, and performance standards for the job directly into the training program.

Manage by fact. Each phase of the ISD process requires constant evaluation against the job requirements identified earlier in the process. In addition, a variety of tools have been developed to ensure that the design and development decisions are made with supporting data. For example, a number of media selection tools are being used to provide training managers with information that matches the training media with the training requirements. These matches are based on learning theories and development cost factors (money and time). ISD is designed to guide training managers and curriculum developers to the awareness of factors affecting their decisions.

Integrate quality in all phases. Evaluation is continuous quality checking. This is true during each phase of the ISD process, from analysis to evaluation. Built-in checks in each phase ensure the quality of the ISD process and training products with emphasis on the trainee's performance.

Evaluate quality constantly. The ISD process is a cyclic, ongoing process of continuous improvements. As you progress through the different phases of ISD, the processes and products of each phase are constantly evaluated against the training requirements and the principles of learning. The results of the evaluations determine which phase of ISD to enter next. Constant evaluation identifies changes in training requirements due to update in equipment and personnel, resulting in new ISD efforts to provide the best possible education and training for Air Force personnel.

Basis of process improvement

The basis of process improvement is Quality Air Force (QAF). QAF is a management philosophy and a methodology that work together to produce continuous process improvements. It is based on ten principles.

All work is a process.
Processes receive work from suppliers, add value and deliver output to customers.
Anyone from whom a process receives work is a supplier.
Anyone to whom a process delivers output is a customer.
Customers have needs and expectations.
Customers will define and measure quality in terms of those needs and expectations.
Quality is meeting customer needs and expectations.
Improving process quality increases productivity.
Processes can be identified, understood, measured, and improved.
The people who operate the processes know best how to improve them.

Procedure for process improvement

In order to ensure process improvements, you will need to use a systematic method to identify and correct the causes of the problems. The six steps of process improvement are outlined below.

Step	Activity
1	Define the process and determine the main problem areas.
2	Analyze the problems and identify the causes of each.
3	Identify and evaluate possible changes to the process.
4	Implement the changes and monitor the process.
5	Institutionalize the changes.
6	Repeat for continuous improvements.

Ways to implement the procedure

There are many different ways to implement the basic procedure mentioned above. Two of the ways are:

"Chart it, check it, change it"
Shewhart Cycle (plan-do-check-act)

Each of these techniques uses the six basic steps mentioned above.

Chart It, Check It, Change It

What it is

This technique is a systematic approach to continuous improvement. This approach has three principal steps, as shown below and in Figure 4.

Step	What You Do
1 Chart It	Describe the process. Gather data.
2 Check It	Analyze the data. Evaluate the process. Identify opportunities.
3 Change It	Improve the process. Institutionalize the change.

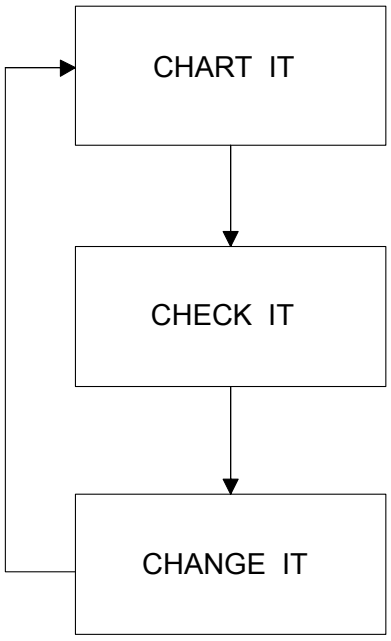
How to use it

Chart It
Using a process flowchart, describe the process to be improved.
Gather data on the process and its products.

Check It
Analyze the data to isolate the problems and opportunities.
Evaluate the process to identify alternative approaches.
Identify opportunities (i.e., useful changes) from the alternatives.

Change It
Improve the process by implementing changes identified as opportunities.
Institutionalize the changes through training, standardization, etc. Then, use another process (or use this same one again) to make further improvements.

Figure 4 Chart It, Check It, Change It



Shewhart Cycle

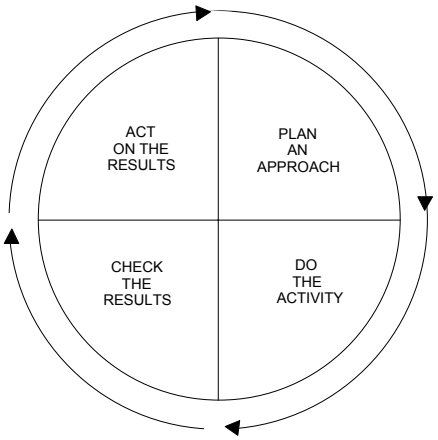
What it is

The Shewhart Cycle is a systematic approach to achieving a continuous improvement in quality. The cycle includes planning, doing, checking, and acting.

Graphic representation

Because the approach involves repetition, it is represented graphically as a circle in Figure 5.

Figure 5 Shewhart Cycle



How to use it

To use the Shewhart Cycle, follow the steps listed below.

Plan an approach for quality improvement. Study the process flow and any existing data. Formulate possible improvements, experiments to be run, or additional data to be gathered.

Do the activity planned. Implement the improvement effort that you planned. Train the people who are responsible for implementation.

Check the results. Measure the results of the improvement effort you implemented. Analyze the data you collected.

Act on the results. If the effort was truly an improvement, standardize and document it. If it wasn't successful, determine what could be done to improve it.

Repeat. Continue around the cycle again by planning and carrying out further activity.

Flowchart: A process improvement tool

Many tools are used to make process improvements. One tool that is often used to analyze process problems is the flowchart.

What it is

A flowchart is a graphical representation of all the major steps of a process. It can help you:

Understand the complete process.
Identify the critical stages of the process.
Locate problem areas.
Show relationships between different steps in a process.

How to use it

Identify the process. Define the start point and finish point for the process to be examined.

Chart the ideal process. Try to identify the easiest and most efficient way to go from the start block to the finish block. While this step isn't absolutely necessary, it does make it easier to find improvements.

Describe the current process. Chart the whole process (i.e., lay out all the steps) from beginning to end. You can use standard symbols to improve the clarity of your flowchart.

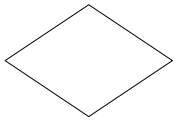
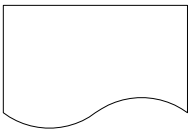
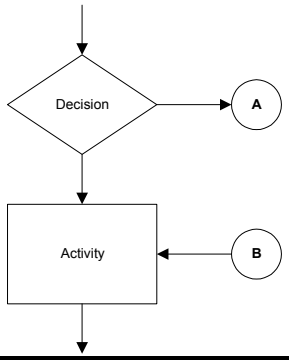
Search for improvement opportunities. Identify all areas that hinder your process or add little or no value. Examine all areas that differ from your ideal process and question why they exist.

Update your chart. Build a new flowchart that corrects the problems you identified in the previous step.

Standard flowchart symbols

Figure 6 depicts the standard flowchart symbols.

Standard flowchart symbols

This symbol…	Represents…	Some examples are…
	Start/Stop	• Receive tasking to develop training. • Complete training development process.
	Decision Point	• Approve/Disapprove. • Yes/No. • Develop training/non-training solution.
	Activity	• Develop objective. • Develop test. • Product training materials.
	Document	• Fill out task analysis worksheet. • Update training development plan. • Document evaluation results.
	Connector (to another page or part of the diagram.)	

Using process improvement methods

There are numerous process improvement tools that can be used to document and improve the training development process. As an instructional developer, you are encouraged to use a process improvement tool such as flowcharting any time you are involved in developing a new process or revising an existing process. Also, if you haven't documented your current training development process, it is recommended that you do so in order to improve the process.

Example of the training development process

Figure 7 depicts the overall training development process used to develop technical training. You may want to adapt this flowchart to the specific or unique needs of your training organization. The blocks that have a number by them represent the stages within the ISD process where the Technical Training Management Systems (TTMS) can help support the process.

Automated training development process

The TTMS is an integrated, computer-based system for the entire technical training environment. The system provides the technical training community with a modernized information environment that includes networks, workstations, data servers, and an integrated suite of Commercial Off-The-Shelf (COTS) software. The TTMS provides training design and development, evaluation, instructor and student management, and resource administration. The TTMS is designed for use by the USAF Air Education and Training Command training centers to increase effectiveness and efficiency of their resident and remote training activities.

Figure 7 Training Development Flowchart (A)

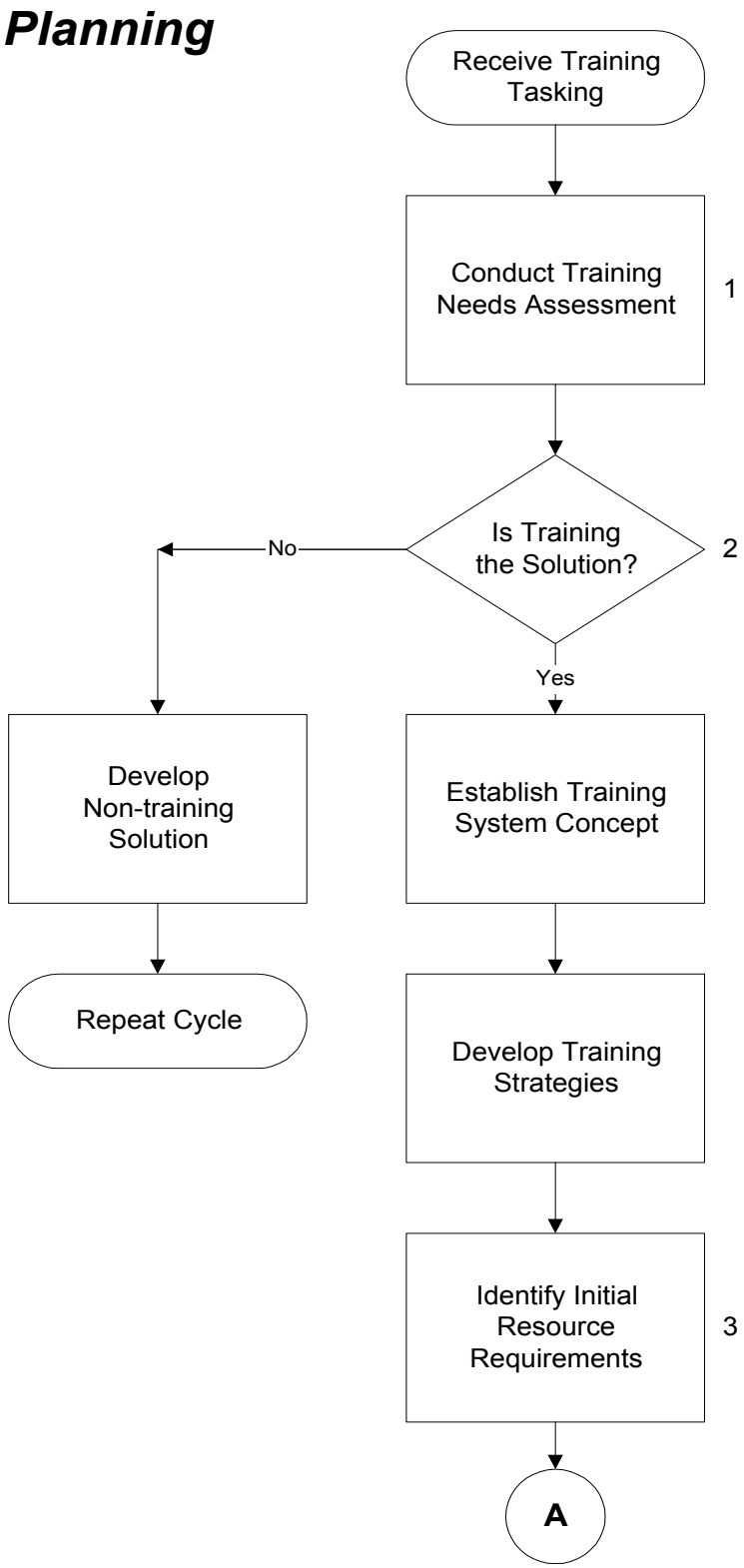


Figure 7 Training Development Flowchart (B)

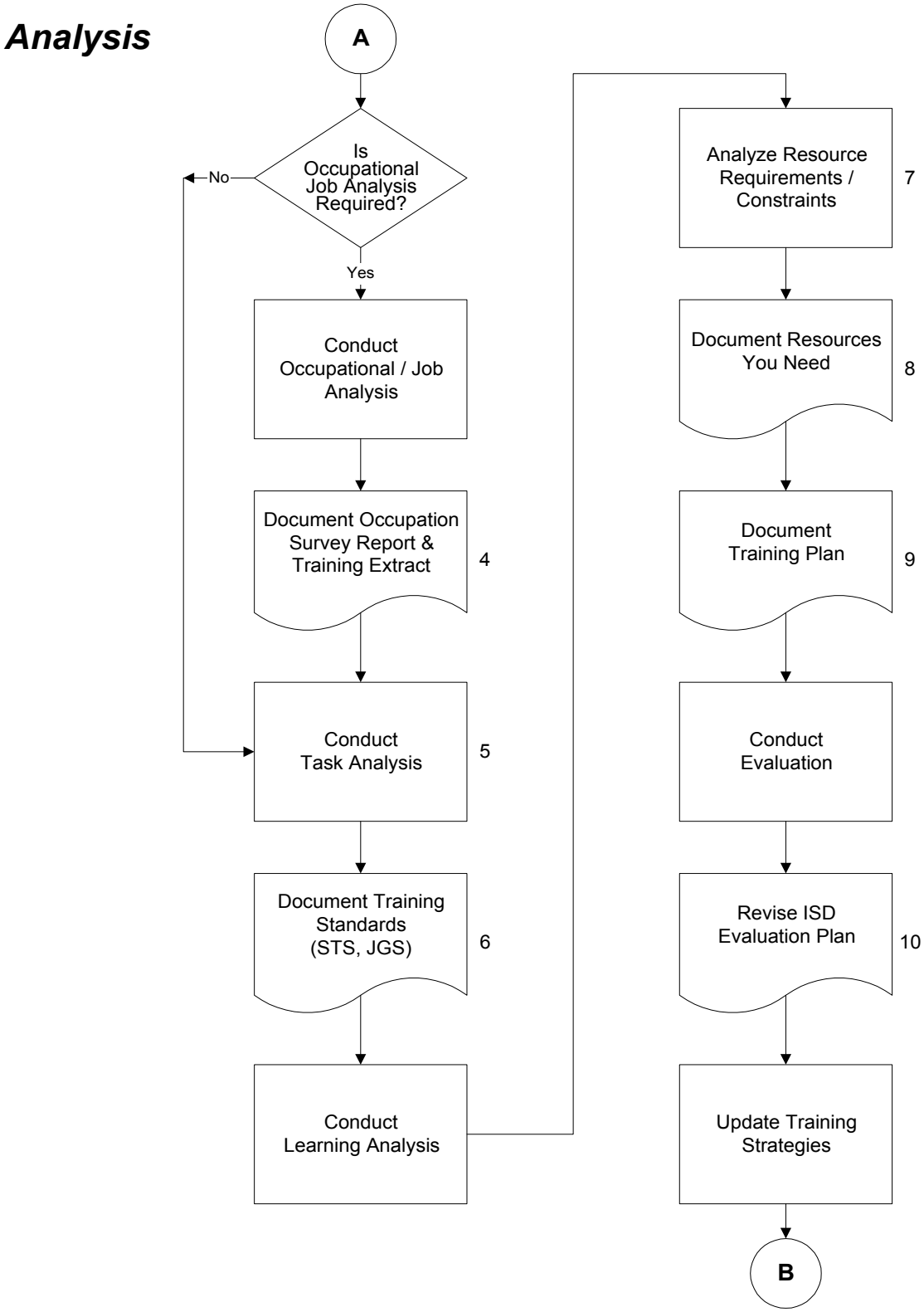


Figure 7 Training Development Flowchart (C)

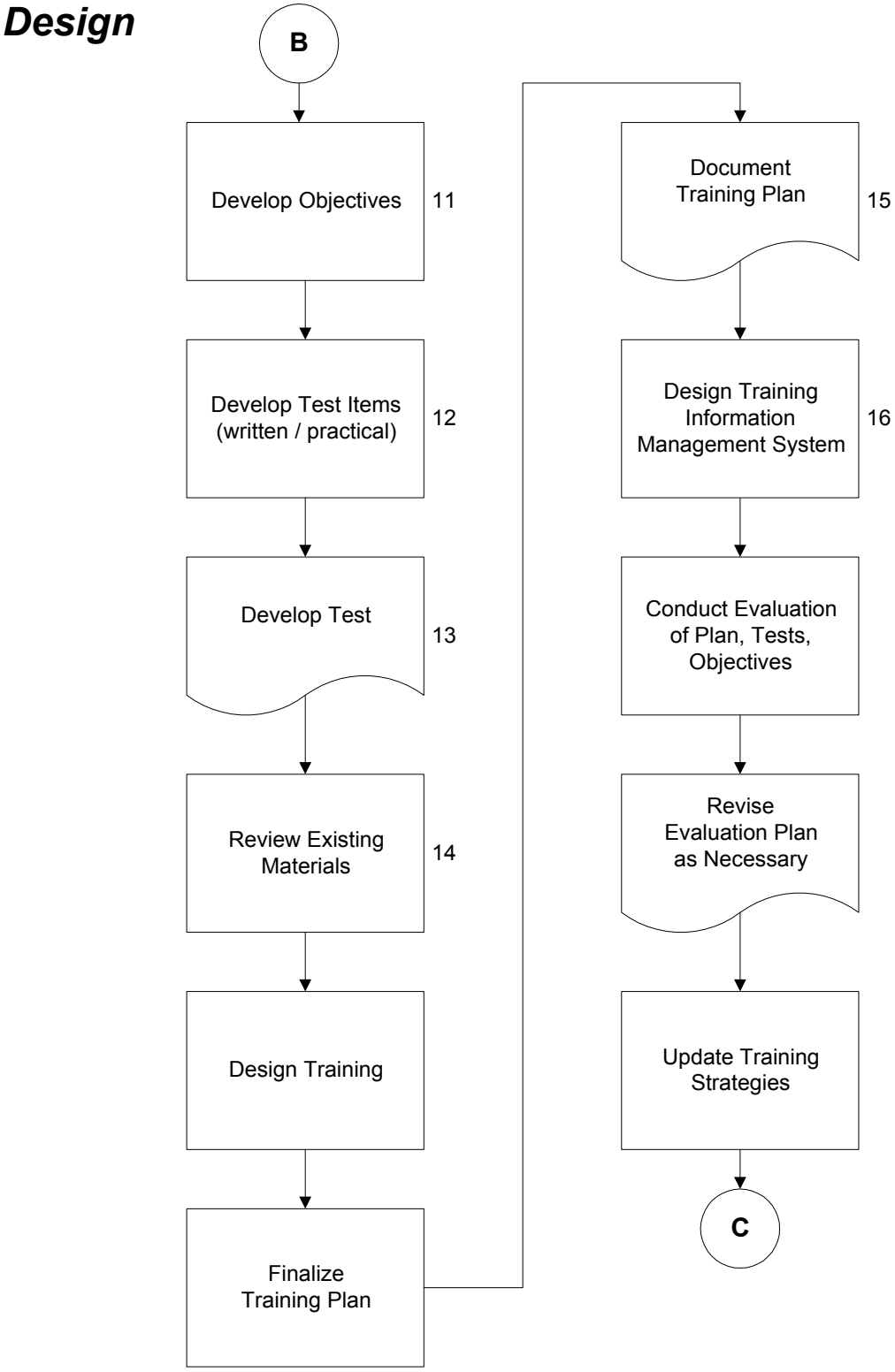


Figure 7 Training Development Flowchart (D)

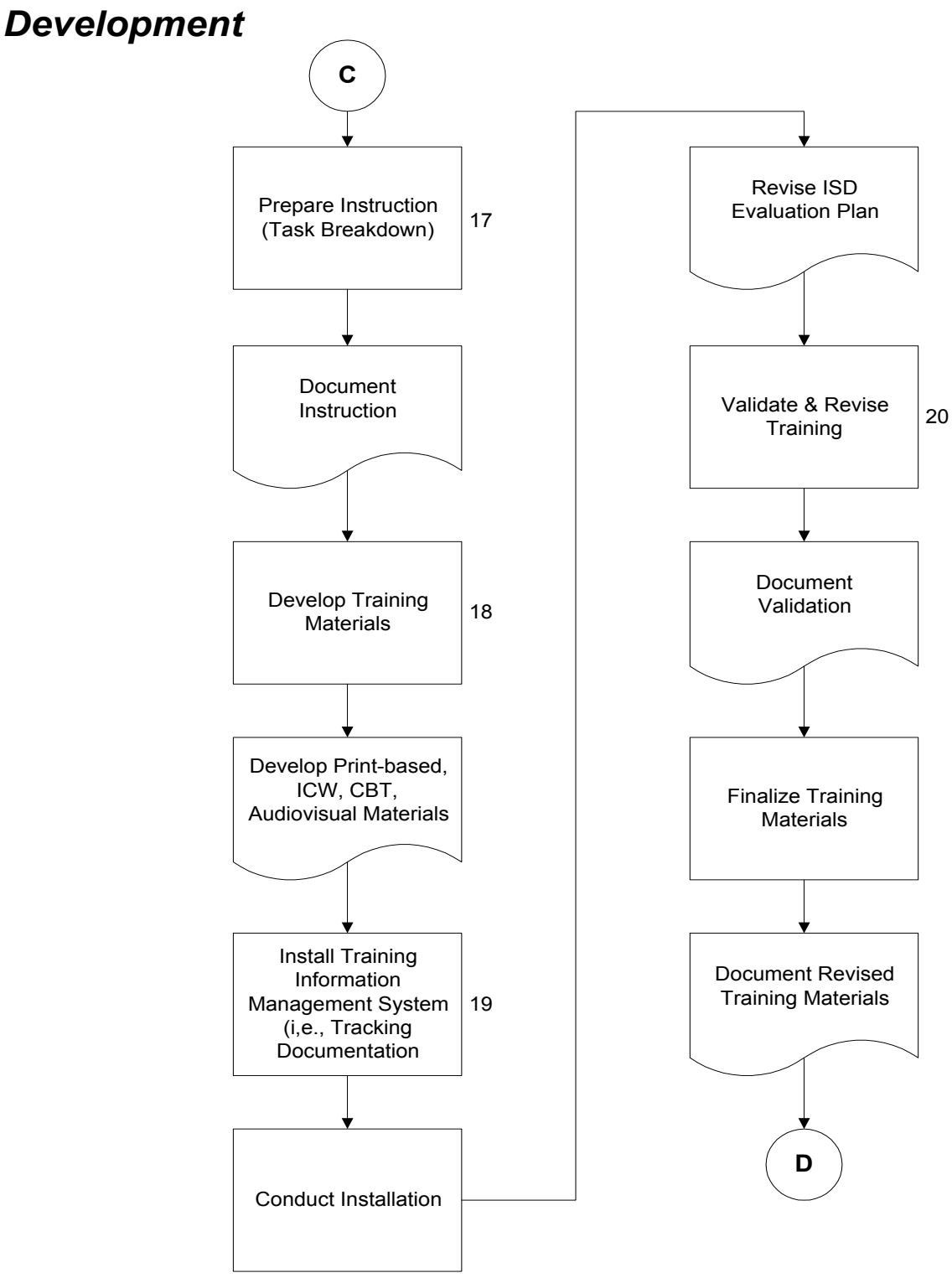
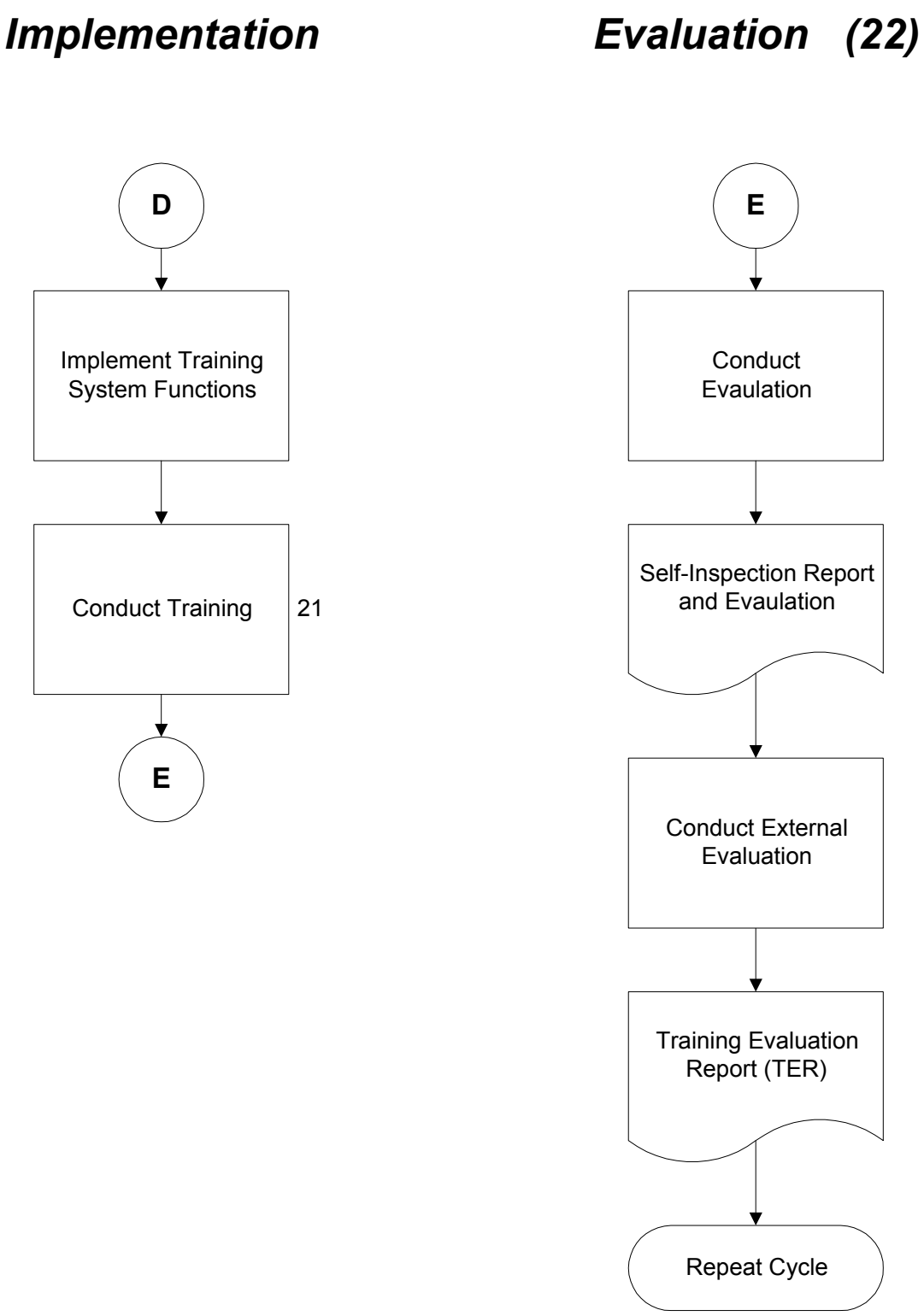


Figure 7 Training Development Flowchart (E)



Metrics

Metrics are standards of measurement or quality indicators that are critical to maintaining quality in the training development process. The purpose of metrics is to provide qualitative and quantitative evaluations of the process and products within each phase of ISD. Metrics are based on key factors such as performance, cost, and schedule. Types of metrics include, but are not limited to, items such as:

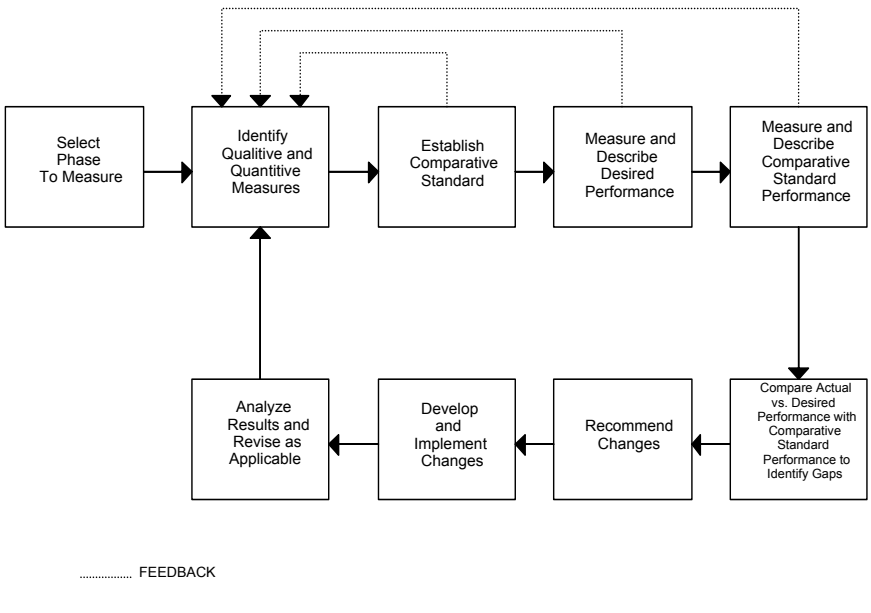
Qualitative
- Directives
- Evaluation criteria
- SME review
- Format guide
- Quantitative

Personnel/skill allocation
- Schedule
- Test and evaluation data

Training system metric process

Figure 8 depicts a typical metric process that can be used to develop and measure technical training. It can be modified to meet specific needs.

Figure 6 Training System Metric Process



Chapter 3
PLANNING

Overview

Introduction

Effective and cost-efficient training systems don't just happen – they must be planned. Planning is a key element in the management of the overall training system as well as in the ISD process itself.

You play a vital role in the system. That role requires you, an instructional developer, to identify any situation where inadequate planning has occurred and report it to your supervisor or manager of the training system. Your input is essential.

Inadequate planning is costly.

Objectives

The objectives of this chapter are to:

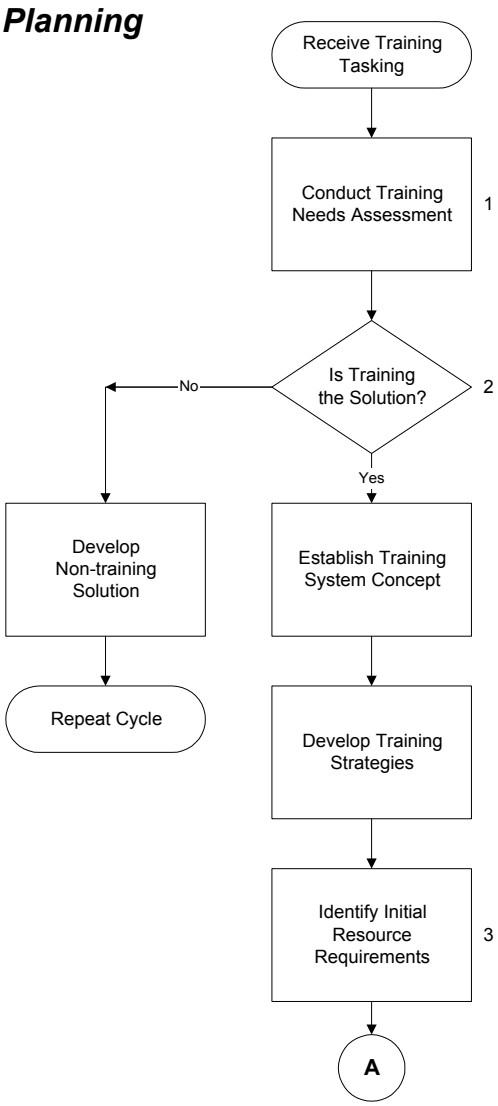
Determine ISD tasking.
Perform the training needs assessment.
Plan and execute training strategies.
Implement identification of resources.

Where to read about it

This chapter contains six sections.

Planning process flowchart

The planning portion of the training development flowchart (Figure 7) is provided below as a quick reminder of the activities involved in planning an ISD project. As a reminder, the numbers on the flowchart represent the activities where the Technical Training Management System (TTMS) can help support the ISD process.



Additional information

For additional information on planning, see:

AFMAN 36-2234, Instructional System Development.
Knirk, F. G. and Gustafson, K. L. (1986). *Instructional Technology: A Systematic Approach to Education.* New York: Holt, Rinehart, and Winston.
Rossett, A. (1987). *Training Needs Assessment.* Englewood Cliffs, New Jersey: Educational Technology Publications.

Section A
Receive Training Development Tasking

Introduction

Your supervisor may tell you to develop a new human relations course or to revise an F-16 fuels course to include new defueling procedures. Did you ever wonder where your boss came up with the need to develop new courses or revise existing courses? In this section, you will learn how your boss may have come up with the tasking which starts the training development effort.

What is a tasking?

A tasking is any formal request to develop new or revise existing training.

Who issues a tasking?

A tasking to develop training may come from different organizations or levels within an organization. Formal tasking will flow through predetermined channels depending on the level and source of its origin.

The following are examples of the different levels from which tasking may be issued.

Functional Manager – Air Staff (HQ USAF)
Functional Manager – Major Air Command (MAJCOM)
Training Manager – Training Center (TC)

Sources of tasking

The tasking to develop training may come from any number of sources. Examples are:

External

Air Force Directives
Utilization and Training Workshops (U&TW)
Training Planning Teams (TPT)
Occupational Survey Reports (OSR)
Training Quality Reports (TQR)
Training Evaluation Reports (TER)

Sources of tasking (Continued)	Internal Self-inspection Student critique Written test analysis
Who is responsible?	Instructional developers or the design team have the responsibility of: Developing effective and cost-efficient training. Ensuring process and product quality. Responding to the users' needs.
Remember	The ISD process starts with a training need, it comes to you in the form of a formal request to develop or revise training.

Section B
Conduct Training Needs Assessment

Introduction

Training is expensive, requiring valuable resources to design, develop, implement and maintain. Before starting to develop training, you should make sure there is a training-related problem. As a matter of fact, if at all possible, you should do a Training Needs Assessment (TNA).

What is a problem or need?

A problem or need is a deficiency or "gap" between actual performance and desired performance. In other words, the "gap" is the difference between what ought to be occurring (optimal) and what is occurring (actual). A problem exists when the actual performance level is below the optimal level of performance that has been established. If the discrepancy is caused by people's lack of skills, knowledge, or attitude to accomplish a job, then you have a training-related problem.

What are some of the problems or needs?

The following are some examples of problems or needs that may call for a TNA.

The personnel turnover rate is increasing.
The number of work-related injuries needs to be reduced.
A recent inspection has indicated that the quality of work needs to be improved.
Equipment downtime needs to be reduced below 10%.
Worker dissatisfaction is widespread.
Deadlines are not met.

Possible causes of the problem

Performance problems have many causes. Some are:

Workers do not have the necessary skills, or knowledge, or attitude to perform the task.
Workers may not know they are doing a poor job. As a matter of fact, they may even think they are doing a great job.
The task is rarely performed on the job so workers forget how to do it.

Possible causes of the problem (Continued)

The work environment is contributing to poor performance because of a poorly designed machine, bad equipment/tools, inadequate layout, insufficient lighting, uncomfortable temperature, etc.
The organization is undermining performance because it tends to punish good performance (e.g., by giving a person more workload).
Workers are overworked (e.g., they have been on two shifts straight).
Workers are absent-minded because of personal problems.

*Only deficiency in skills, knowledge, or attitude calls for a **training** solution.*

What is TNA?

TNA is a systematic process to determine if a performance problem is training-related.

Remember

The purpose of a TNA is to analyze the actual training need to determine how to solve the problem.

Training is the solution for skills, knowledge, and attitude deficiencies, and nothing else.

When is TNA Done?

Ideally, TNA should be done before any other planning takes place. You should make sure there is a training problem before you start planning a training solution.

Stages of TNA

In general, a TNA consists of six stages as outlined below.

Stage	Activity
1	Define purpose.
2	Identify data sources.
3	Select and develop data gathering methods.
4	Collect data.
5	Analyze data.
6	Document findings and make recommendations.

Stage 1: Define purpose

In the initial stage of TNA, you need to know:

Who is involved, who wants the problem solved, who needs the problem solved, who is causing the problem, etc.
Where to get the information.
Nature of the problem.

Stage 2: Identify data sources

After you have initially defined the purpose of the TNA in general terms, you need to identify possible sources of data. Examples are:

Functional manager
Subject matter experts
OSR
TER
TQR
IG/standard evaluation reports
Technical data
Job descriptions
Job performance requirements
Work samples
Records
Reports

Stage 3: Select data gathering methods

Data gathering methods may include:

Survey questionnaires
Interviews
Observations
Group meetings
Analyses of work samples and related documents

Stage 4: Collect data

The table below shows what you do for each data collection method.

Stage 4: Collect data (Continued)

Method	What You Do
Questionnaire	Ask the worker if he/she can do the task.
Interview	Ask the supervisor if the worker can do the task.
Observation	Have the worker do the task in your presence.
Analysis of Work Samples, Records and Reports	Review the worker's performance records to determine if he/she can do the task.

Stage 5: Analyze data

After data collection, you need to analyze the data that you have collected to:

Determine if the performance gap is caused by the worker's lack of required skills, knowledge, or attitude.
Confirm the accuracy and quality of the data gathered by:
- Having individuals who provided the information review the data and analysis results.
- Rechecking the data.
- Verifying the results of the analysis. If the problem is not training-related, you should notify appropriate individuals to ensure that the problem is further addressed.

Stage 6: Document findings and recommend solutions

After you have verified the accuracy of data and analysis results, you need to:

Document the problem.
Identify the cause.
Recommend solutions to the problem.

Before making a training recommendation

Before making a training recommendation, make sure training is justified. Consider the following questions:

How critical is the task?
How many people perform the task?
How difficult is the task?
How frequently is the task performed?
Would it be more cost-efficient to contract the task?

Because training is expensive, **do not** recommend a training solution unless:

The task is highly critical i.e., inadequate performance will result in injury or loss of life, damage to equipment, or mission degradation.
Many people perform the task.
The task is highly complicated and difficult to learn.
The task is performed frequently.

Possible constraints

You may face resource constraints when you conduct a TNA, such as time, personnel, or money. If possible, you should work around the constraints to the best of your ability. The following is a brief example of some alternative methods of collecting data.

Job aids

A simple job aid can be designed to help determine when to develop formal training. Two examples of job aids are provided below.

Example 1

To use the job aid, simply provide the required information. The information will help determine if the training development effort is justified.

Job aids (Continued)

Justification For Training
1. State the performance problem this training is to solve.
2. State the evidence that the target population does not have the skills, knowledge, or attitudes to do the task(s).
3. Explain why the task is worth training: Safety Task criticality Task difficulty Number of members performing Frequency of task performance
4. Explain why the following alternatives are not feasible: Provide a job aid Find qualified workers
5. List sources that have been searched for existing training.
6. List existing training material identified, if any.
7. Final decision: _____ Don't develop training; refer to _____. _____ Develop new training. _____ Revise existing training.
8. Explain why existing training is not used or needs revision.

Example 2

To use the following job aid, simply use the rating scale to fill in the number of individuals performing the task and rate each task according to criticality, difficulty, and performance frequency (shaded area). In the case of the first task, the number performing is many (2), criticality is high (3), difficulty is moderate (2), and frequency is high (3). As a rule of thumb, if many people perform the task or the number in the total column adds up to seven or more, or the task is critical to safety, formal training should be developed. Keep in mind there may be other factors raising the importance of a task needing training.

Job aids (Continued)

	1 = Few 2 = Many	1 = Low 2 = Moderate 3 = High				
Task Name	**Number Performing**	**Criticality**	**Difficulty**	**Frequency**	**Total**	**Is the Task Worth Training?**
Refuel/Defuel F-16	2	3	2	3	10	Yes
Change B-52 Wiper Blades	1	1	1	1	4	No
Run Engine KC-135	2	3	3	3	11	Yes
Tow C-5 Aircraft	2	3	1	3	9	Yes
Wash Canopy	1	2	1	2	6	No

Before you finish

Before you complete the TNA, perform a quality check. Ask the following questions.

Self-Check Questions
1. Have you clearly identified a performance problem?
2. What is the evidence that indicates the problem is caused by a lack of skills, knowledge, or attitudes in the workers? Is the evidence sufficient?
3. In assessing the worth of a training solution, have you carefully considered each of the following criteria? Safety Number of members performing Task criticality Task difficulty Frequency of task performance
4. Have you considered all the alternatives to training? Is training the most cost-efficient way to solve the problem?

Section C
Establish Training System Concept

Introduction

The training system concept provides the framework for applying the ISD process. It provides your best initial estimate of what the instruction should do and what it should look like. The determination of the needs and the application of learning theory guide determination of a training system concept. Instructional developers or design teams are normally not responsible for establishing a training system concept. However, they need to make sure that a concept has been established before developing training. Whether it has been established or not, they will get involved in the process.

Developing a training system concept is the first stage of planning.

What is a training system concept?

A training system concept is the initial, broad definition of:

Why the system is being developed or revised.
What type of training is involved?
When the system needs to be implemented to meet users' requirements.
Where the system will be implemented – resident, field unit, or others.
Where the system and process will be managed.
Who will be responsible?

The concept is the first "fuzzy" picture of the training system.

Why do you need a concept?

A training system concept serves as the basis for overall system planning. Although the concept may change later, right now it gives you the needed focus and direction for all further activities.

Who is responsible?

As an instructional developer or member of a design team, you normally do not develop training system concepts. This responsibility usually falls on the manager of the system. However, you may be called upon to provide input.

How is a concept developed?

Concept planning does not require a long, laborious process or a great deal of documentation. Focus on getting the training system concept down on paper so you have a basis for future planning. Don't be bogged down by the process or the documentation. The concept is what's important.

The best way to develop a concept is to select an appropriate team and have a "brainstorm" session. If you can't assemble a team, do it yourself. Put your ideas on paper or a marker board. Keep refining them until you have a concept for the system.

To formulate a concept, try to answer questions you or your team members may have about the system. Some example questions are listed.

Areas of Concern	Example Questions
System	What is the purpose of the system? Why is the system changing? What is the nature of the change?
Target Audience	Who will receive the training? What is the background and experience of the students? How many students require the training?
Training	Was a specific type of training requested? What is the most appropriate delivery method? Are the identified training needs current? Where will the training be conducted?
Resources	What is the possible resource impact? What are the possible resource constraints? If there are constraints, what are the possible alternatives?
Responsibilities	Who has management responsibilities? Who has support responsibilities? Who has development responsibilities? Who will conduct the training?

How is a concept developed? (Continued)

Answering these types of questions, as well as others, helps establish the training system concept.

Section D
Develop Strategies

Introduction

Once you have established the training system concept, it is time to develop the strategies or plans to support implementation of the concept. Be aware that the strategies you develop now will more than likely be revised in each successive phase of the ISD process.

What are strategies?

Strategies identify and document:

What must be done and the resources required to do it.
Why it needs to be done.
Who is responsible for doing it?
How it is going to be done.
When it needs to be completed.

Why have strategies?

Strategies or plans should:

Provide the "roadmap" for training system development and process management.
Establish the system and process milestones.
Ensure development of effective and cost-efficient training systems.

Scope of strategies

The scope of the strategies should cover:

Management strategies, which include both system and process management.
Evaluation strategies, which include formative, summative, and operational evaluations.

Who is responsible?

The responsibility for developing strategies falls on the managers of the system. However, various organizations may provide input to the manager. Examples of inputs that may come from other organizations are listed below.

Who is responsible? (Continued)

Organization	Input
Logistics	Maintenance Resources Equipment
Services	Student housing Student messing
Engineering	Facilities Environmental
Resource Management	Personnel Facilities utilization Supply

Considerations

Each ISD project requires different strategies. You may consider the following areas:

Training system management.
- How the system will be managed.
- Who will manage the training system?
- Project milestones.
- Resource requirements.
- Resource need dates.
- Support organizations and their responsibilities.
- Constraints/alternatives.
- Quality improvement requirements.
- Plans for managing the training system.

Process management.
- Process management requirements and responsibilities.
- How the process will be managed.
- Plans for managing the process.
- Process milestones.
- Resource requirements.
- Resource need dates.
- Constraints/alternatives.
- Quality improvement requirements.

Updating strategies

As you progress through the various phases of ISD, you need to constantly update the strategies to reflect current planning and project status.

Section E
Develop ISD Evaluation Plan

Introduction

Whether you call it evaluation or quality improvement, *it's important*. As a manager, one of your top priorities is to develop a plan to evaluate the training system during analysis, design, development and implementation. Evaluation ensures that a total quality system is developed. The evaluation plan may be a subset of the plan or a separate plan.

Quality concerns

Quality is your first and last concern when making plans to develop a new training system or revise an existing system. The concern for quality continues throughout each phase of the process.

Evaluating or assessing the quality of the process and products of each phase of instructional development is the foundation of ISD, and it ensures customer satisfaction.

Why have a plan?

An ISD evaluation plan is necessary to establish what and how you are to evaluate during the training development process. The plan, which is the metric for quality, ensures that the ISD process results in a total quality system.

Who is responsible?

Managers are responsible for developing a comprehensive ISD evaluation plan including formative, summative, and operational evaluations. Some organizations may have an evaluation office to prepare this plan. However, everyone is responsible for quality.

What is in the plan?

The ISD evaluation plan is to include information sufficient to ensure that the ISD process results in total quality in both process and products. The plan may include, but is not limited to, the following information:

Identification of responsibilities including tasking.
Scope and purpose of the evaluation.
How and when the evaluation activities are to be accomplished.
Documentation and report requirements.

Section F
Identify Resource Requirements

Introduction

The most critical element in ISD is resources. Throughout the entire ISD process, resources will always be your major concern. Regardless of your role in the training system, you have a resource responsibility. In the planning stages of ISD, your responsibility is to identify the resource requirements to design, develop, implement, and continue to maintain a training system.

What is a resource?

"Resource" in this handbook refers to:

Equipment – training, support, spare
Facilities – classrooms, laboratory, range
Human Resources – instructional developers, instructors, students
Money – equipment, facilities, and personnel cost
Time – development time, course time

Who has the initial responsibility?

Although each individual in the training system has a resource responsibility, managers have the initial responsibility, during the planning stage of the ISD project, to identify the types and amounts of resources required to support the system.

Consider the following questions when you are identifying resources.

Sample Questions for Identifying Resources
System
What are the system requirements?
Is it a new system or a revision to an existing system?
What is the training need?
Has management specified a particular delivery method?
What are the system and process strategies?

Who has the initial responsibility? (Continued)

Sample Questions for Identifying Resources
Equipment What and how much training equipment will be needed? What and how much support equipment will be needed? What and how many spares will be needed? Are there any equipment constraints? If so, what are they?
Facilities What type of facilities will be needed to conduct or support training? Will a new facility be required or can an existing facility be used? If an existing facility is used, will it require modification? Are there any facility constraints? If so, what are they?
Human Resources How many instructional developers will be needed? How many instructors will be required? What type and how many people will be needed for support activities? How many students per year will need to be trained? Are there any personnel constraints? If so, what are they?
Funds How much will it cost to design, develop and implement the course? How much will it cost to support, operate, and maintain the course? Are there any funding constraints? If so, what are they?
Time Are the identified training needs current? How long will it take to design and develop the course? How long will the course be? Are there any time constraints? If so, what are they?

Revising initial requirements

At this point, you may not be able to answer all of those questions. However, later in the training development process, you will be able to define the resource requirements more clearly.

Sources of identifying resources

The results of your initial planning will be valuable sources of information when you identify resource requirements. Other sources are:

SMEs
System specifications
Technical data
Missions/system requirements
Directives
Existing systems

Availability of resources

Resource availability is critical to effective and cost-efficient training development. You cannot do a good job unless you have the necessary resources at the right time.

Early identification of resources helps ensure that resources are available when needed.
For example, some training may require:

More than two years for long-lead equipment.
One year for an instructional developer or instructor.
Three years for a Military Construction Project (MCP).
Four to five years for the budget process.

How do you deal with constraints?

You will probably always be working under some kind of constraint. You will seldom have all the resources you need or would like to have.

How do you deal with constraints? The table below suggests some alternatives to work around resource constraints.

How do you deal with constraints? (Continued)

Resource Constraints and Possible Alternatives

Equipment
- Borrow equipment from the user or other training organizations.
- Share equipment with user or other training organizations.
- Build training devices rather than use actual equipment.
- Use equipment on two shifts.
- Use larger group sizes on equipment.
- Use different delivery methods or media.

Facilities
- Use temporary facilities.
- Operate multiple shifts.
- Share facilities with user or other training organization.
- Use part-task trainers rather than full simulators.
- Use different delivery methods or media.

Human Resources
- Borrow SMEs from the user to develop the training system.
- Borrow instructional developers from other training organizations.
- Increase student group size.
- Reduce course length.
- Use different delivery methods or media.

Funds
- Use part-task trainers rather than full simulators.
- Increase the group size (less equipment).
- Reduce course length.
- Borrow equipment.
- Select less expensive delivery methods or media.

Time
- Use additional personnel to design and develop training.
- Design and implement a shorter version of the course.
- Use different delivery methods and media.
- Work overtime.

Ensure that work-arounds to resource constraints are acceptable to the user, the work- arounds are temporary, and there is a permanent resource solution.

Chapter 4
ANALYSIS

Overview

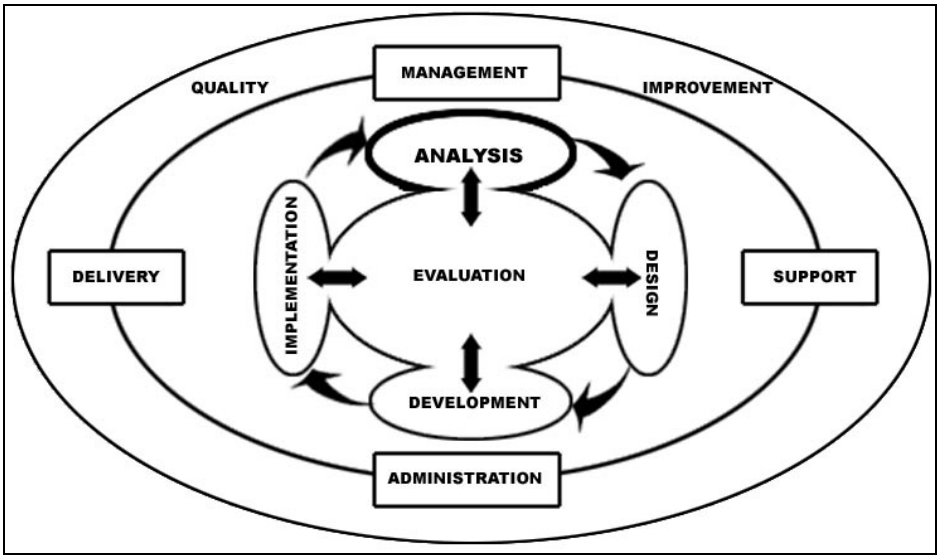
Introduction

Before entering the actual ISD process, make sure adequate planning and preparation have been accomplished. The previous chapter discussed all the tasks that need to be performed in order to get ready for the ISD process. The nature and scope of each ISD project will be determined by the assessed training deficiency or training requirement established by the user. This chapter discusses various activities that are performed during the analysis phase of the ISD process. Training that is developed or revised based on objective, valid, and reliable analysis is likely to be more accurate and appropriate than training that is not.

Where are you in the process?

In order to help you visualize where you are in the process, the ISD model is represented in Figure 9 with the analysis phase highlighted.

Figure 7 Analysis Phase



Objectives

The objectives of this chapter are to:

Initiate various analyses.
Plan and execute training plan development.
Determine the requirement to update the management strategies.
Perform the requirement to update the evaluation plan.

Where to read about it

This chapter contains seven sections.

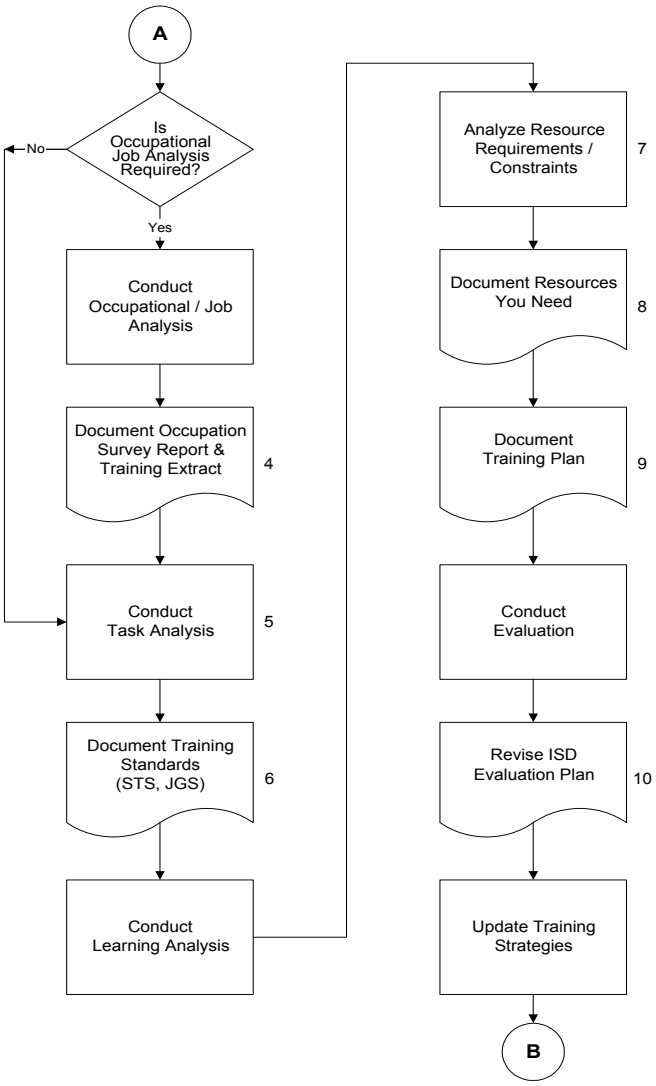
Section	Title	Page
A	Conduct Occupational/Job Analysis	69
B	Conduct Task Analysis	73
C	Conduct Learning Analysis	87
D	Analyze Resource Requirements/Constraints	94
E	Develop Training Plan	100
F	Update ISD Evaluation Plan	102
G	Update Management Strategies	104

Analysis process flowchart

The analysis portion of the training development flowchart (Figure 7) is provided on the following page as a quick reminder of the activities involved in the analysis process. As a reminder, the numbers on the flowchart represent the activities where the Technical Training Management System (TTMS) can help support the ISD process.

Analysis process flowchart (Continued)

Analysis



Additional information

For additional information on analysis, see:

Carlisle, K. E. (1986). *Analyzing Jobs and Tasks*. Englewood Cliffs, New Jersey: Educational Technology Publications.

Wolfe, P., Wetzel, M., Harris, G., Mazour, T. and Riplinger, J. (1991). *Job Task Analysis: Guide to Good Practice.* Englewood Cliffs, New Jersey: Educational Technology Publications.

Leshin, C. B., Pollock, J. and Reigeluth, C. M. (1992). *Instructional Design Strategies and Tactics.* Englewood Cliffs, New Jersey: Educational Technology Publications.

Section A
Conduct Occupational/Job Analysis

Introduction

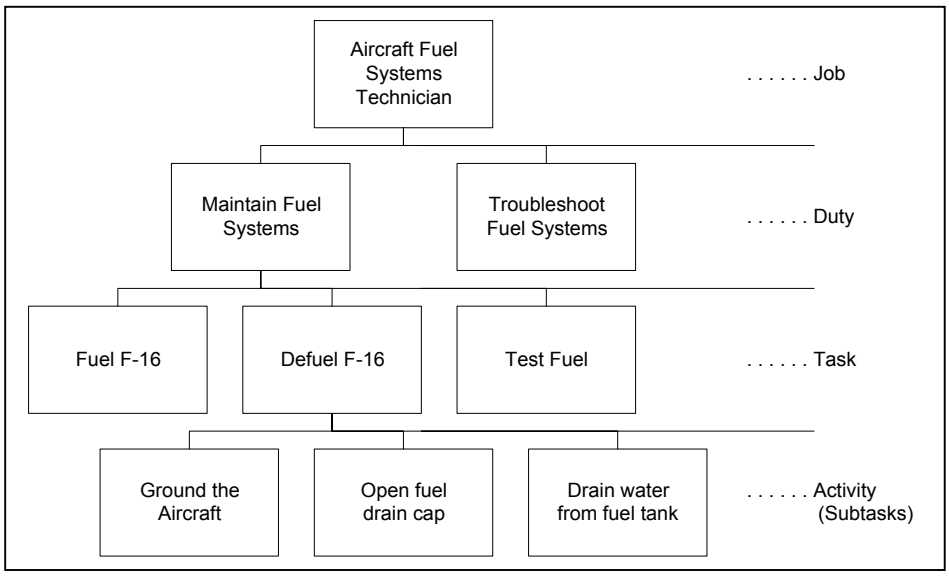
Before you begin the analysis phase of ISD, make sure you have identified a problem that can be solved with training. Training can solve only performance problems caused by a performer's lack of skill, knowledge, and ability to perform a task. If training cannot solve the identified performance problem, do not enter the ISD process.

This section explains the first activity, occupational/job analysis, in the analysis phase.

What it is

An **occupational or job analysis** identifies the jobs that define an occupational entity and then identifies duties and tasks that comprise each job. It starts by breaking a job into various duties that are the major segments or divisions of the job. The duties are further broken into tasks that make up each duty. Figure 10 illustrates the breakdown of a job into duties and tasks.

Figure 8 Job Breakdown



Why occupational/job analysis?

An occupational/job analysis allows instructional developers to break a job down to a list or inventory of tasks, which will be further analyzed in the subsequent task analysis.

Who is responsible?

The USAF Occupational Measurement Squadron (OMSq) has the responsibility for periodically collecting and analyzing data from each occupation or job in the Air Force. The results of the job analyses are reported in Occupational Survey Reports (OSRs) that are distributed throughout the Air Force. If there is a need for a survey before the scheduled time, the Air Force functional manager or AETC training manager for that Air Force Specialty Code (AFSC) can request an OSR.

As an instructional developer or member of a design team, you normally are not responsible for occupational/job analysis. However, you may be asked to complete a job inventory or serve as a subject matter expert (SME) for your AFSC during the analysis. As a manager or developer, you will be using the OSR and training extract developed by OMSq to determine what tasks require training.

Sources of job analysis data

Data for job analysis can be gathered from many sources, such as:

Existing OSRs
Job inventories
SMEs
Technical Orders
AF publications such as regulations and manuals
System specifications/requirements
MAJCOM inputs
System Program Office (SPO) inputs
Contractor data

As you can see, there is a wide variety of data sources. Other data sources may be available depending on the occupation or job being analyzed.

How to conduct a job analysis

Since it is unlikely that you will conduct an occupational or job analysis, the process will only be outlined. The basic tasks are:

Develop an inventory of tasks that make up the job. To develop an inventory, you should:
- Review documentation from similar jobs.
- Use existing training standards for the Air Force Specialty (AFS).
- Use SMEs to provide detail job information.
- Observe jobs being performed.

Validate the task inventory by using questionnaires to collect data from the field.

Analyze the data from the questionnaires and prioritize the tasks. Tasks are normally prioritized based on:
- Percent of the members who perform each task.
- Learning difficulty of each task.
- Training emphasis of each task.

Recommend the appropriate method of training for each task such as classroom, on-the-job training (OJT).

Document survey results in an OSR and training extract. Information in an OSR may include:
- Complete listing of all job tasks.
- Percent of members performing each task. This information is also listed by MAJCOM, skill level, grade, and member's time in the career field.
- Learning difficulty of each task.
- Training emphasis rating of each task.
- Recommended method of training.

Occupational measurement squadron to TTMS interface

The TTMS will import OSR task factors as well as task analysis data. Having this data in an automated system assists in analyzing the tasks by providing a means to sort and associate various tasks according to their task factors. This analysis will allow you to quickly determine which tasks should be trained in the classroom or by OJT.

Additional information

Occupational or job analysis is a highly technical process requiring personnel in various specialized areas such as development of job inventories, data analysis, etc. If you need additional information, see:

AFI 36-2623, Occupational Analysis.

Section B
Conduct Task Analysis

Introduction

Now that an occupational/job analysis has been conducted and the tasks that make up the job have been identified, you are ready to start the next stage of analysis, analyzing the tasks. Since every job in the Air Force is made up of numerous duties and each duty is made up of many tasks, it is unlikely that you could ever identify and analyze each task that personnel might perform within a given AFS. However, as a training developer, you will need to be an expert at task analysis since failure to do a good task analysis will likely result in an ineffective training system.

What it is

A **task** is normally an observable and measurable unit of work activity or operation that forms a significant part of a job. It constitutes a logical and necessary step in performance, and has a logical beginning and end. It may also be defined as a series of actions leading to a terminal outcome such as "maintain an F-16 fuel system" or "operate a P-19 fire truck."

Task analysis is the process of breaking a task down and identifying:

Component steps of a task.
Sequence of those steps.
Conditions or limits under which the task will be performed such as what tools, equipment, materials or information will be needed to perform the task.
Standard of performance that must be achieved.

Purpose

During task analysis, each task is analyzed to determine performance requirements such as which tasks must be performed, the conditions under which they are performed, and the performance standard that must be achieved. This information, which becomes the task statement, is used to develop the objective for the course and to sequence the training.

Data collection

As an instructional developer, your first step in task analysis will be to collect the necessary data for analysis. As you begin to collect the data, you will find there are many sources that you can collect data from.

Data sources

Some of the data sources are:

OSR
Technical Orders (TOs)
Job Aids
Checklist
Training Documentation
AF Regulations and Manuals
Standard Operating Procedures
MAJCOMs (user)
System Program Office (SPO)
Manufacturer's Manuals
Contractor's Data
SME

Data collection techniques

When collecting data, consider the following techniques:

Review job-related documents such as TOs, job aids, and checklists.
Observe actual job performance.
Interview SMEs.
Conduct survey/questionnaire.
Use simulations.
Analyze similar systems.
Make assumptions.

Questions to ask

When collecting data, ask appropriate questions to collect different types of information.

Questions to ask (Continued)

To Identify . . .	Ask the Question . . .
Procedures, activities, or steps.	What does the student do first? Next?
Tools or materials.	What is used to do the task?
Weapon systems, or computers.	What is the task performed on?
Cues.	How does the student know when to do what?
Work environment or conditions.	Under what condition is the task performed?
Performance standards.	What is the standard of acceptable performance?

Identifying tasks

After you have identified the duties and written the duty statements, you are ready to identify the tasks involved in each duty. When identifying the tasks:

Use all of the available data sources.
Don't hesitate to assume that some tasks are required, even if they are not identified in the data that you have collected.

Task criteria

Understanding the criteria for the task will help identify tasks during the analysis phase of ISD. Task criteria are listed on the following page.

Task criteria (Continued)

Task Criteria
A task is a group of related physical or mental activities directed toward a goal. A task has a definite beginning and end. A task involves people interacting with equipment, media, and other items. A task may be directly or indirectly observable. A task is measurable. A task is an independent part of a duty. A task, when performed, results in a meaningful product or process. Tasks include activities such as physical, decision making, problem solving, knowledge, attitudes and perceptions that are required of individuals. A task may be any size or degree of complexity.

Guidelines for task statements

Identifying tasks is a repeating process based on human activities that meet the above criteria. Each time it is repeated, the results of the process are made more complete or accurate. Continually repeating the process refines the list of tasks. The process should be continued until the list covers every task making up the duty.

After you have identified the tasks that make up the job, the next step is to develop a list of task statements. You should follow specific guidelines and standards to ensure that you develop quality task statements. The guidelines are provided below.

Guidelines for Developing a List of Task Statements	
Step 1	Arrange major duty responsibilities in order of typical performance. Indicate which ones are performed in a fixed order and which ones have no particular order.
Step 2	Translate duty responsibilities (or human functions) into a list of task statements, composed of an action verb and an object.
Step 3	Edit the list according to the standards that are provided on the following page.

Standards for task statements

The standards to be used when developing task statements are provided below.

Standard	Task Statement	Example
Clarity	Use wording that is easily understood.	"Compare written description to actual performance." **But Not** "Relate results to needs of field."
	Be precise so it means the same thing to each individual.	Use words such as "check, coordinate, assist" with caution. They are vague.
	Write separate, specific statements for each. Avoid combining vague items of skill, knowledge, or responsibility.	"Maintains files." **But Not** "Has responsibility for maintaining files."
Completeness	Use abbreviations only after spelling out the term.	"Inventory War-Readiness Material (WRM)" may be followed by "Prepare requisitions for WRM."
	Include both form and title number when the task is to complete a form, unless all that is needed is the general type form.	"Complete Task Description Worksheet (Form No. 123)."

Standards for task statements (Continued)

Standard	Task Statement	Example
Conciseness	Be brief.	"Write production and control reports." **But Not** "Accomplish necessary reports involved in the process of maintaining production and control procedures."
	Begin with a present-tense action word (subject "I" or "you" is understood).	"Clean" or "Write."
	Indicate an object of the action to be performed.	"Clean engine." "Write report."
	When there are several different techniques or methods of doing a task, adding condition phrases to the task statement may be necessary.	"Draw samples using Bacon Bomb Samples." "Draw samples using Dewar Samples." **Instead of** "Draw fuel samples."
	Use terminology that is currently used on the job.	"Use most recent AF Documentation."
Relevance	Do not state a person's qualifications.	"Load computer tape." **But Not** "Has one year computer training."
	Do not include items on receiving instruction, unless actual work is performed.	"Prepare lab report." **But Not"** "Attend lecture."

Sample task statements

The following is a sample of satisfactory task statements.

Function or Duty	Sample Task Statements
Sorting items of mail into pigeon- holes.	Sort mail.
Taking a patient's history.	Interview patient to determine medical history.
Fixing carburetors.	Adjust carburetor or replace carburetor. (Depends on what is meant by "fix.")
Deciding where to begin trouble- shooting of (specific electronic item).	Formulate troubleshooting strategy for (specific item of equipment).
Establishing the objectives for a course.	Specify course objectives.

Identifying subtasks

After you have identified the tasks that make up the duties of a job, it is time to identify the subtasks. Subtasks are work activities that, when combined, make up a task. It should be noted that not all tasks are made up of subtasks. There are several reasons for identifying subtasks.

For some task statements to be useful in training development, the developers must identify the subtasks so they will know the steps that are involved in performing the task.

Complex tasks can be analyzed more easily if they are broken into subtasks.

Breaking a task into subtasks often helps the instructional developer sequence the training.

Guidelines for identifying subtasks

Two basic guidelines for identifying subtasks are shown below.

Guidelines for Identifying Subtasks	
Step 1	Examine each task statement. See if it contains more than one group of activities that must be performed sequentially or independently.
Step 2	Review the complete list of subtasks for each task. Make sure that no subtask overlaps, and that together they account for all performance required in the task.

Example of subtask

The following is an example of subtasks that make up a task.

Example of Subtasks	
Job:	Supply
Duty:	Operate Forklift
Task:	Perform Pre-operation Inspection
	Subtasks
	Check oil and coolant for proper levels. Check tires for proper pressure. Check all belts for excessive wear. Check all hoses for leaks.

Sequentially and independently performed subtasks

As you identify the subtasks, you should be aware that some subtasks must be performed sequentially while other subtasks can be performed independently. An example is provided below.

Sequentially Performed Subtasks	Independently Performed Subtasks
Task: Try out training materials.	Task: Recognize and respond to emotionally disturbed patient's need.
Subtasks: Reproduce adequate copies. Administer materials and test. Collect data. Analyze data. Revise materials.	Subtasks: Consider patient's feelings. Consider patient's preference whenever possible. Maintain calm, supportive attitude. Treat patient consistently from visit to visit. Show impartiality in patient care.

Validated task information

Now that you have analyzed the data and determined the duties contained within the job, the tasks that make up each duty, and the subtasks involved in each task, your next step is to verify the information. For each ISD effort, the data collected and the results of the data analysis need to be verified. There are several techniques you can use for verifying and deriving task lists. Examples are provided in the following table.

Function	Technique
Verifying assembled task lists for an existing job.	Questionnaires SME interviews Task observations of performance expert
Deriving a new task list for a new job.	Interviews Questionnaires Simulation Assumptions

Selecting tasks for training

After you have verified the data, it is time to select the task to be taught in the course. OSR data and the training extract provide information that helps you determine which task should be taught. However, if you are not using OSR data or a training extract, consider the following issues when selecting the tasks to be taught in the course.

Can most job incumbents perform the task without training?
How often is the task performed on the job?
Will job degradation occur if the task is not taught?
Is the task critical to the job or the mission?
Is it economical to teach the task?
Is there enough time to teach the task adequately?
If students are trained to do another task, will they be able to transfer what they have learned to perform this task without additional training?
Will geographical, procedural, and environmental conditions make it unreasonable to train everyone to perform the task?
How many people perform the task? What is the percentage performing the task?
Is the task difficult to learn?
If students are trained to perform the task, will they remember how to perform the task when they get to the job?

Document task analysis results

You may use a variety of formats to document task analysis results. A simple way is to use a Task Analysis Worksheet like the one shown on the next page. Regardless of the format that you choose, document only the necessary identification, training, and support information. The key is to provide adequate information in order to develop the objectives in the next phase of the ISD process.

Task analysis worksheet

A task analysis worksheet is provided to help you collect sufficient data. You may modify it to meet your needs.

Job Aid - Task Analysis Worksheet	
Job:	
Duty:	
Task:	
Task Attribute:	**Description:**
Output (desired behavior)	
Standard of Performance (time, rate, percent, etc.)	
Equipment (equipment required to perform task)	
Tools (tools required to perform task)	
Safety (safety considerations when performing task)	
Cue (what prompts performance)	
Location (where the task is performed)	
References (documentation used in task performance such as job aids, and TOs.)	
Human Interface (others involved in performing the task)	

Also, the task analysis worksheet should identify each subtask. An example is provided below.

Subtask	
Subtask Attribute:	**Description:**
Knowledge (facts, concepts, principles, rules, and cognitive strategies required to perform the task).	
Skill (skill necessary to perform the task).	
Attitude (interest, motivation necessary to perform the task).	

Developing training standards

Once the tasks to be taught in the course have been selected and documented, the training standard for the course should be developed. There are several different formats for standards depending on the type of course you are developing. Following are examples of a course training standard and a specialty training standard. For additional information on developing standards, see AFR 8-13.

Example: Course Training Standard

Task, Knowledge, and Proficiency Level	
1. ISD Process	B
2. Job Performance Hierarchy	
a. Hierarchy Of Performance	B
b. Write Duty And Task Statements	2b
3. Conduct Job Needs Assessment	2b
4. Data Sources	B
5. Data Collection	
a. Task Factors	B
b. Conduct Interviews	B
c. Conduct Job Observation	2b
d. Develop Survey Instrument	2b
6. Prepare Initial Job Task Inventory	2b
7. Conduct Goal Analysis	2b
8. Document Job Performance Requirements	2b
9. Prepare Training Development Plan	B
10. Identify Target Population	2b
11. Select Tasks Requiring Training	2b
12. Identify Type Of Training Required	2b
13. Identify Long-Lead-Time Resource Requirements	2b
14. Prepare Training Standard	2b
15. Behavioral Domains	B
16. Complete Training Task/Knowledge Analysis	2b

Example: Specialty Training Standard

1. Tasks, knowledge and technical references	2. Certification for OJT				3. Proficiency codes used to indicate training information provided	
	A Start date	B Completion Date	C Certifying Official's Initials	D Trainer's Initials	A 3-skill level resident course	B Specialized course 7520
4. TRAINING PROGRAM DEVELOPMENT AND ASSISTANCE						
a. Assist in development of unit/individual training programs TR: AFRs 4-61, 4-72, 35-41 Vol. II, 39-1, 50-23, AFMANs 36-2234 and 36-2236, AFH 36-2235						
(1) Analyze work center/duty position requirements						
(a) Interview subject matter specialists					c	#
(b) Identify day-to-day work requirements					2b	#
(c) Research applicable directives					2b	#
(d) Review mission statements					2b	#
(e) Develop questionnaires to assess requirements					2b	#
(f) Review past production records					2b	#
(g) Review applicable training standards (i.e., STS, AFJQS, CJQS, etc.)					2b	#
(h) Identify special work requirements					2b	#

Example: Specialty Training Standard (Continued)

	A Start date	B Completion Date	C Certifying Official's Initials	D Trainer's Initials	A 3-skill level resident course	B Specialized course 7520
(i) Determine mandatory AFSC requirements					2b	#
(j) Determine training capability					b	#
(k) Identify recurring training requirements					2b	#
(l) Review manning documents					2b	#
(m) Review staff assistance / inspection reports					b	#
(n) Identify wartime tasks					b	#
(2) Define workcenter / individual training requirements						

Section C
Conduct Learning Analysis

Introduction

Now that the tasks to be trained have been determined, you may feel you are ready to start designing training. However, before starting you need to conduct a learning analysis. Conducting a learning analysis will aid you immeasurably when designing training. Results of the learning analysis enable you to design training based on desired learning outcomes.

What it is

Learning analysis is the process of analyzing the tasks to be taught to establish learning outcomes in terms of types of learning involved and level of learning desired.

Purpose

Learning analysis serves several purposes in the training development process. It translates tasks into learning outcomes, identifies prerequisite learning requirements, establishes the requirement for entry behavior, and builds a learning hierarchy. Learning analysis sets the stage for designing the training.

When to conduct learning analysis

Learning analysis should be done immediately after the task analysis has been completed and before designing the instructional system. However, this analysis may also be conducted while the objectives are being developed.

Who conducts learning analysis?

Instructional developers or the design team are responsible for conducting the necessary learning analysis. However, managers have the overall responsibility of ensuring that a learning analysis is performed, as necessary.

Learning analysis steps

When you conduct a learning analysis, you should:

Identify the skills and knowledge needed to support performance.
Build a learning hierarchy of knowledge and skills to be taught.
Identify the types of learning involved.
Determine the level of learning needed.
Identify prerequisite knowledge and skills required.

Learning analysis procedures

Learning analysis allows you to determine the best way to structure the training to ensure that it is effective and cost-efficient. The two steps in the learning analysis procedure are:

Step 1 – Categorize tasks
Step 2 – Identify prerequisite requirements

Step 1 – Categorize tasks

The first step in learning analysis is to categorize tasks according to types of learning outcomes. Learning theorists have categorized human activity into types of learned behavior. Gagné's (1985) categories of learning types are the most inclusive. They include intellectual skills, verbal information, cognitive strategies, motor skills, and attitudes. Gagné suggests that each type of learning requires different internal conditions for processing to occur. Internal conditions may be cued or prompted by external conditions present in the learning environment.

Types of Learning

Intellectual Skills. Intellectual skills are the foundation for all higher learning. They consist of discrimination, concepts and rule-using. Cognitive strategies are often called a higher-order type of intellectual skill.

Intellectual skills are hierarchical in nature. In order to learn a higher-order skill, the learner should possess the prerequisites. To learn a rule or principle, the learner should understand the component concepts and the relationships among the concepts.

Discriminations. Discriminations are skills related to seeing differences between stimuli. Most adult problems in discrimination come from physical disabilities like color blindness, hearing loss, or some injury that affects sensory perception.

Concrete Concepts. Concrete concepts are skills related to categorizing physical objects into one or more classes based on their physical attributes. Identifying resistors from among other electrical components is an example of concrete concept learning.

Defined Concepts. Defined concepts are skills related to classifying symbolic objects into one or more classes based on a definition. The definition is actually a rule for

Step 1 – Categorize tasks (Continued)

classification. For example, classifying a verbal statement from an officer as a command is an example of a learned defined concept.

Rule Learning. Rule learning skills relate to applying principles or procedures to solve problems. Problem solving is the ability to recall relevant rules and use them to solve a novel problem. The product of problem solving is not only a solution to the problem, but also learning a new rule or procedure to be used if a similar situation should arise in the future.

Verbal Information. Verbal information is the learning of names and labels that can be verbalized. It is also called declarative knowledge. Verbal information learning requires some basic language skills. In addition, verbal information is more readily retained when it is learned within a larger context of meaningful information.

Cognitive Strategies. The basic premise of an information-processing model is that individuals mentally process their environment. This process consists of a number of stages in which the stimuli become information, which is given meaning by previous knowledge and current expectations. Cognitive strategies are employed to maintain the knowledge in short-term memory and translate it to a structure that enters long-term memory as a type of knowledge in the form of propositions, productions or schemas.

Cognitive strategies are thought of as executive control mechanisms for learning. Monitoring the use of strategies is "metacognition." Cognitive strategies used in metacognition are called metacognitive strategies.

There are different types of cognitive strategies such as clustering items into similar groups to reduce memory load, reading strategies to increase comprehension, and others. Good learners have a variety of strategies they can use to process new information.

Motor Skills. Motor skills are learned behaviors that involve the smooth coordinated use of muscles. Motor skills most often involve a sequence of activities that may be described verbally as an "executive subroutine." This verbal information

Step 1 – Categorize

tasks (Continued)

is learned to provide guidance for learning the execution of the motor skill. When the learner has acquired the motor skill, the verbal routine is no longer needed and the skill is performed in a smooth and continuous manner.

Motor skills may be learned by modeling, as when a coach shows a student how to swing a golf club.

Motor skills require practice and kinesthetic (natural) feedback. Verbal feedback from an observer also helps the learner make corrections in performance. Much of the instruction is aimed at getting the student to recognize the feel of the motor performance when it is executed correctly.

Attitudes and Motivation. The acquiring of particular attitudes may require the prior learning of intellectual skills or particular sets of information. For example, if a positive attitude toward safety is to be acquired, the learner should have (1) intellectual skills (concepts and procedures) associated with safety, and (2) a variety of verbal information about the advantages of following safety procedures or the consequences of not following them.

Attitudes have mutually supportive relationships. An individual generally tries to maintain consistency with regard to choice behaviors. However, attitudes are based on perceptions of reality. Misinformation or critical experiences color these perceptions. Attitudes are learned by observing others and viewing the consequences of their behavior. This type of learning (vicarious) is a distinct principle of social learning. External conditions for learning attitudes include a human model.

Experiences play a major role in the formulation of attitudes.

Motivation plays a significant role in learning. Keller (1987) has developed a general model integrating the various sources of motivation for learning. He calls it the ARCS model, an acronym for the four sets of conditions that should be met to have a motivated learner:

Step 1 – Categorize tasks (Continued)

A for attention.
Attention involves grabbing the learner's interest at the beginning of instruction and maintaining that interest throughout the lesson and course.

R for relevance.
Relevance is the personal significance and value to the learner of mastering the learning objectives.

C for confidence.
Confidence relates to the learner's expectancy of success.

S for satisfaction.
Satisfaction comes from achieving performance goals.

Integration of Human Activities. In real life, the types of learning are integrated. This integration is discussed in terms of schemas, enterprise theory and metaskills.

Schemas. Intellectual skills should be integrated into existing knowledge to be remembered and recalled. They are thought to be stored as schemas and as part of propositional networks. A schema is an organization of memory elements (propositions, images, and attitudes) representing a large set of meaningful information pertaining to a general concept. The concept may be of an object, such as a jet fighter, weapon, or officer. Or it may be an event, such as a preflight check or preventive maintenance procedure. Regardless of type, schemas contain information on certain well-understood features of the object or event. The learner fills in these features, called slots, when encountering new information that relates to the schema. Schemas are acquired through experience and may be the greatest benefit of apprenticeships.

Recent theory proposes that intellectual skills are "situated." That means their utility is in a large part a function of how they are learned. In order that they do not become "inert knowledge," they should be learned and practiced within a broader context.

Step 1 – Categorize tasks (Continued)

Enterprise Theory. Gagné and Merrill (1990) proposed a method to identify learning goals that requires an integration of multiple objectives. They proposed that such an integration of multiple objectives be conceived in terms of the pursuit of a comprehensive purpose in which the learner is engaged, called **enterprise**. An enterprise is a purposeful, planned activity that may depend for its execution on some combination of verbal information, intellectual skills, and cognitive strategies, all related by their involvement in the common goal. A task for the instructional developer is to identify the goal of a targeted enterprise along with its component skills, knowledge, and attitudes, and then to design instruction that enables the student to acquire the capability of achieving this integrated outcome.

Metaskills. The metaskill concept (Spears, 1983) refers to the complex skills of adapting, monitoring, and correcting the use of individual skills in complex performances that integrate cognitive, perceptual, and motor processes. Proficiency in metaskills depends on the number of individual skills practiced. Plateaus in performance are related to the intervals required for students to put together new sets of metaskills.

Processes involved include:

- Gaining organic knowledge of the effects of actions on overall goals.
- Organizing knowledge hierarchically to include cause-effect rules.
- Developing monitoring procedures that incorporate outcome expectancies.

Internal events of information processing

Events of instruction are a set of communications embedded in instructional activities. They serve the function of activating internal events of information processing. The learning process is shown in the following table.

Internal events of information processing (Continued)

Learning Process	Learning Phase
Expectancy	Motivation
Perception	Apprehending
Working Storage	Acquisition
Encoding	Processing
Storage	Retention
Retrieval	Recall
Validation of Understanding	Feedback
Transfer	Generalization
Valuing	Personalizing

Different types of learning outcomes require different training strategies. This activity enables you to design training based on the desired learning outcome, which results in more effective and cost-efficient training.

Step 2 – Identify prerequisite requirements

After the tasks have been categorized into appropriate learning outcomes, your next step is to identify the prerequisite requirements. This step identifies the entry level skills, knowledge, and attitudes required for the target audience to achieve the task performance requirements.

Additional information

Additional discussions on tasks, task descriptions, learning outcomes, prerequisite learning, and the hierarchy of objectives or learning will be provided in the next chapter under the discussion on developing objectives.

Section D
Analyze Resource Requirements/Constraints

Introduction

Resources are critical in every step of training system development, from the initial planning, through training development, to operation and maintenance of a training system. During analysis, you probably will not be able to determine the exact resource requirements. However, you need to identify long-lead-time resource requirements such as training equipment and facilities in order to allow sufficient time to secure the needed resources or to work out alternatives in case of resource constraints.

What are resources?

Training resources are the supplies and support required to design, develop, implement, support, operate, and maintain a training system. Resources for a training system are categorized into five major areas:

Equipment
Facilities
Funds
Personnel
Time

Why analyze resources?

Resource analysis allows you to identify and estimate the resources required to design, develop, support, operate, and maintain a training system. Resource analysis identifies:

Course development resources.
Quantity of resources required such as number of instructors, classrooms, and trainers.
When the resources are needed in order to meet the training delivery date.
Total cost of resources.
Resource limits.

Who is responsible?

Many training and support personnel and organizations such as instructional developers, resource management, and support services, are responsible for analyzing and identifying resources. Managers have the overall responsibility to ensure availability of adequate resources.

Before analyzing resource requirements

Before you begin analyzing resource requirements, keep the following things in mind.

Equipment

Identify major system-peculiar or unique equipment items as early as possible in the ISD process since they normally undergo a cycle of design, development, production, and testing prior to their use in a training system.
Failure to identify training, support, and test equipment requirements early may delay training implementation.
Do not order or procure equipment until course objectives have been tentatively set to make sure there is a valid requirement for the equipment.
When selecting equipment, consider:
- Suitability or appropriateness.
- Usability.
- Reliability.
- Maintainability.
- Cost.

Facilities

Identify facility requirements as early as possible because:
- Time required to get funds is normally long.
- Time to build new facilities or modify existing facilities can be considerable.

Funding

You must prepare or revise a budget and get funds appropriated to allow for:
- Procurement of equipment.
- Construction or modification of facilities.

Before analyzing resource requirements (Continued)

Personnel costs such as payroll, temporary duty (TDY) for instructors or students.

Budgets are normally submitted and approved long before money is actually spent. Therefore, managers and instructional developers must determine as precisely as possible what resources will be required for the training system.

Human Resources

Lead-time for additional personnel such as instructional developers, instructors, student allocations, and maintenance support can be lengthy since it involves budget and personnel authorizations.
When requesting personnel such as instructional developers and instructors, allow sufficient time to properly train them to do their assigned duties.
Identify additional support personnel such as typists and hardware fabricators, if applicable.

Time

If possible, allow sufficient lead time to:
- Obtain the necessary equipment.
- Build new or modify existing facilities.
- Get personnel authorizations approved and personnel properly trained.
- Secure the required funding.
- Design, develop, and implement an effective and cost-efficient training system.

Analyzing resource requirements

Finding answers to the questions below will help you analyze the resource requirements for the training system.

Analyzing resource requirements (Continued)

Resource	Sample Questions
Equipment	What types of equipment will be required (training, support, test)? Will training equipment need to be developed? Is the equipment classified? What is the lead-time for equipment and parts? What equipment will be required (simulators, computers, maintenance stands, multimeters)? Where and how will the equipment be obtained? How will the equipment be used in the course? What quantities will be required? What is the life cycle of the equipment? In case of an equipment constraint, can alternative equipment be used? If so, what equipment? Will safes be required to store classified documents? Who will maintain the equipment?
Facilities	What types of facilities will be required (classrooms, laboratory)? Will a vault be required to store classified material? Will it be necessary to have secure classrooms? How much space will be required? Are facilities available on the base? If facilities are available on the base, will they require modifications? Who will do maintenance/housekeeping of facilities (contract or in-house)? Does the facility meet environmental requirements, if applicable?
Funds	What are the initial costs of equipment, facilities and personnel? What are the recurring costs associated with operating the training system? Are there TDY costs associated with training development or the conduct of the course?

Analyzing resource requirements (Continued)

Resource	Sample Questions
Human Resources	How many instructional developers will be required to meet the training delivery date? Will qualified instructors be needed? If so, how many? What specialties? Will maintenance support be required? If so, will additional maintenance personnel be required? What are the student allocation requirements? Will the training system require additional overhead personnel?
Time	What is the training delivery date? How much time will be required to develop the training? Are there any equipment lead-time requirements? If so, how much? If new or modified facilities are required, how long will it take? What is the estimated course length?

What about resource constraints?

Air Force resources are normally in short supply and, therefore, you may not be able to obtain what you need to support your training system. When faced with a resource constraint, refer to the actions/alternatives listed below for your consideration.

Constraint	Action/Alternative
Equipment	Borrow equipment belonging to other training organizations or MAJCOMs. Secure equipment from bases no longer in need of it. Share equipment with other training organizations or MAJCOMs. Use prototype equipment. Use a trainer or simulator rather than the actual equipment. Increase group size on the equipment. Operate multiple shifts. Increase class intervals. Temporarily "X" items in the training standard.

What about resource constraints? (Continued)

Constraint	Action/Alternative
Facilities	Use temporary facilities. Use other training organizations or MAJCOM facilities. Operate on multiple shifts. Decrease the group size. Increase the class intervals. Temporarily "X" items in the training standard. Delay class start dates.
Funding	Reduce the resource requirements. Seek alternative funding sources. Temporarily "X" items in the training standard.
Human Resources	Reduce the number of graduates produced. Borrow instructional developers or instructors from other training organizations or MAJCOMs. Reduce the multiple instructor requirements. Temporarily "X" items in the training standard.
Time	Borrow additional personnel such as instructors from other training organizations or MAJCOMs. Reduce course length. Select alternative methods or media.

Updating resource requirements

In initial planning and analysis, you identify the resources required to support and service the training system. As training development progresses through the design and development phases of ISD, you will need to continually redefine and fine-tune system resource requirements. Updating resource requirements helps ensure availability of adequate resources to support your training system.

Section E
Develop Training Plan

Introduction

From the very beginning of this handbook the importance of planning has been stressed. If you are to have an effective and cost-efficient training system you must continually make and update plans as required. Lack of sufficient planning or the failure to continually update the plans may result in less than adequate training. A part of the planning required in the analysis phase is developing a training plan, which may also be called a training implementation plan, or which may be a subset of another plan. The training plan development process usually starts in the latter stages of the analysis phase, when you have adequate data to start documenting your plan for the training system. Development of the training plan will normally continue through the design phase of ISD and possibly into the development phase before it is finalized.

What it is

A **training plan** describes the training system in terms of:

Purpose
Type of training
Training design
Training content
Course parameters
Resources required

Training plans may include resource and course control documents such as:

Personnel documentation
Equipment listings
Training standards
Course charts

*The training plan should **never** document, nor should it contain, any information that is not necessary to describe and document the training system.*

Purpose of training plan

A well-developed training plan can serve several purposes depending on the nature and scope of the training itself. Some of its purposes are to:

Describe and document the training system.
Identify resources that are required to operate and support the training system.
Serve as the approval document to operate the training system.

A training plan may serve other purposes depending upon the need or requirement to describe and document the training system.

Who is responsible?

Managers are directly responsible for developing a plan to describe and document the training system. In an effort to develop a training plan, the manager will need inputs from training and support personnel such as instructional developers, instructional staff, resource managers, base environmental coordinator, and others as required.

Section F
Update ISD Evaluation Plan

Introduction

During initial planning, you develop a strategy for evaluating the quality of the process and products of each ISD phase. This strategy or plan becomes the "metric" or standard for evaluating the products generated by each ISD phase. To ensure that the ISD evaluation strategy is effective throughout the life cycle of the project, you need to update it periodically.

Assessing quality

During analysis, you may ask questions such as the following when updating your evaluation strategy.

Does the evaluation strategy for the analysis phase assess both process and product quality?
Are the quality standards for the analysis process and products adequate and realistic?
Can the job analysis process be improved? If so, how?
Can the job analysis products be improved or simplified? If so, how?
Do the job analysis products provide the necessary information? If not, what additional information is needed?
Is there any information in the job analysis products that is not needed and can be deleted from the product?
Are other job analysis products needed? If so, what products are needed?
Can the task analysis process be improved? If so, how?
Can the task analysis products be improved or simplified? If so, how?

Why update evaluation strategy?

Each ISD project is different in nature and scope, and therefore requires a different evaluation strategy. As you complete the analysis phase, you may want to update the evaluation strategy to reflect the results of your evaluation efforts during analysis. The updated strategy will ensure a current and accurate ISD evaluation strategy for the subsequent design process and products of that phase.

Who is responsible?

Everyone involved in training development is responsible for the quality of the ISD process and products. Various individuals including instructional developers may be involved in developing or updating the ISD evaluation strategy. Managers have the overall responsibility for the evaluation strategy.

What should you do?

It is essential that you keep the ISD evaluation strategy updated. Items to be updated may include:

Analysis products such as task analysis worksheets or OSRs
Quality standards for evaluation
Evaluation procedures
Evaluation schedules
Products to be evaluated

After you have revised the above items, you need to:

Document the evaluation results of the analysis phase.
Provide rationale for changes made to the ISD evaluation strategy.
Document lessons learned in evaluating the analysis process and products.

Tracing the quality process

Quality of the analysis process and products is very important to the training development process. Document the evaluation of the analysis phase to ensure that the quality process can be traced throughout the entire ISD process. Document only as needed. Do not document just to fill a case file.

Section G
Update Management Strategies

Introduction

Management strategies are developed early in the initial planning stages to serve as a "roadmap" for managing the training development process and the training system. In the analysis phase, you may want to update those strategies as more and better information becomes available concerning management issues.

Importance of management strategies

The management strategies developed during the initial stages of planning allow you to enter the analysis phase with a "plan." Without such a guide, development could be slow and haphazard. Management strategies:

Serve as "tools" to manage the process and the system.
Establish process and system milestones to ensure that training is delivered to the user on time.
Ensure development of an effective and cost-efficient training system.

Why update management strategies?

It is necessary to update the management strategies to reflect any changes resulting from the analysis phase of ISD. For example, it took six weeks longer than expected to complete the task analysis. If you do not update the management strategies with this new information, all subsequent milestones in the analysis phase and the remaining phases of the ISD process will be off by six weeks. It is important for you to update the management strategies after each phase of the ISD process or when any significant change occurs.

Who is responsible?

Managers are responsible for ensuring that the management strategies are updated with the most current information at the end of each ISD phase or after a significant change has occurred.

What should you update?

When updating management strategies at the end of the analysis phase, include the latest information such as:

- Changes to the overall strategy for managing the training system or process
- New or revised milestones
- Refinements to project definition
- Changes in resource constraints
- Revisions to resource requirements
- Addition or deletion of taskings

Chapter 5
DESIGN

Overview

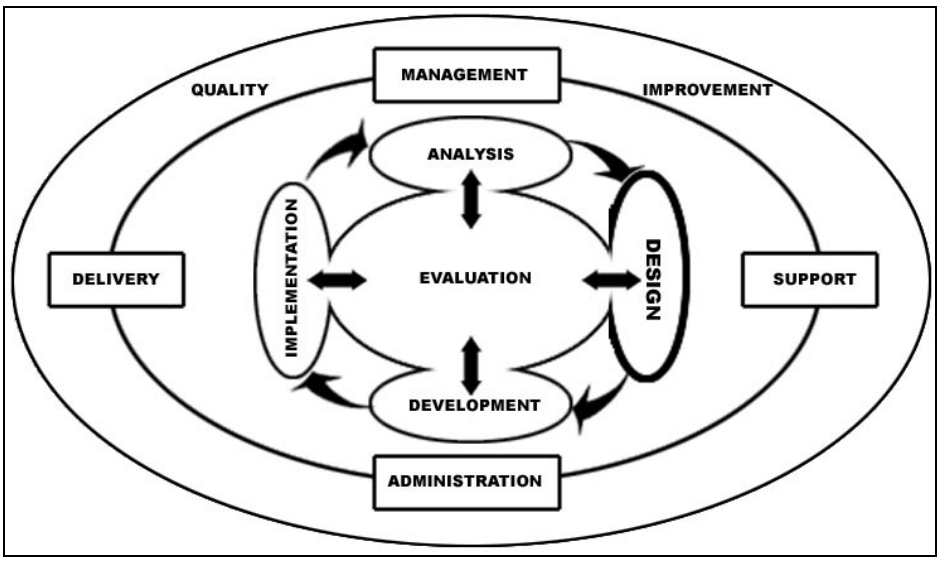
Introduction

During the design phase, you, as the instructional developer or member of the design team, built the framework for the training by developing objectives and designing the instruction. What you do here plays a key role in determining the effectiveness and cost-efficiency of the training you will develop in the next phase of the ISD process. Also in this phase, as well as throughout the entire ISD process, you will be concerned with the quality of the process and products.

Where are you in the process?

At this point, you enter the design phase of training development. An ISD model with the design phase highlighted is presented in Figure 11 to help you visualize the ISD process.

Figure 9 Design Phase



Objectives

The objectives of this chapter are to:

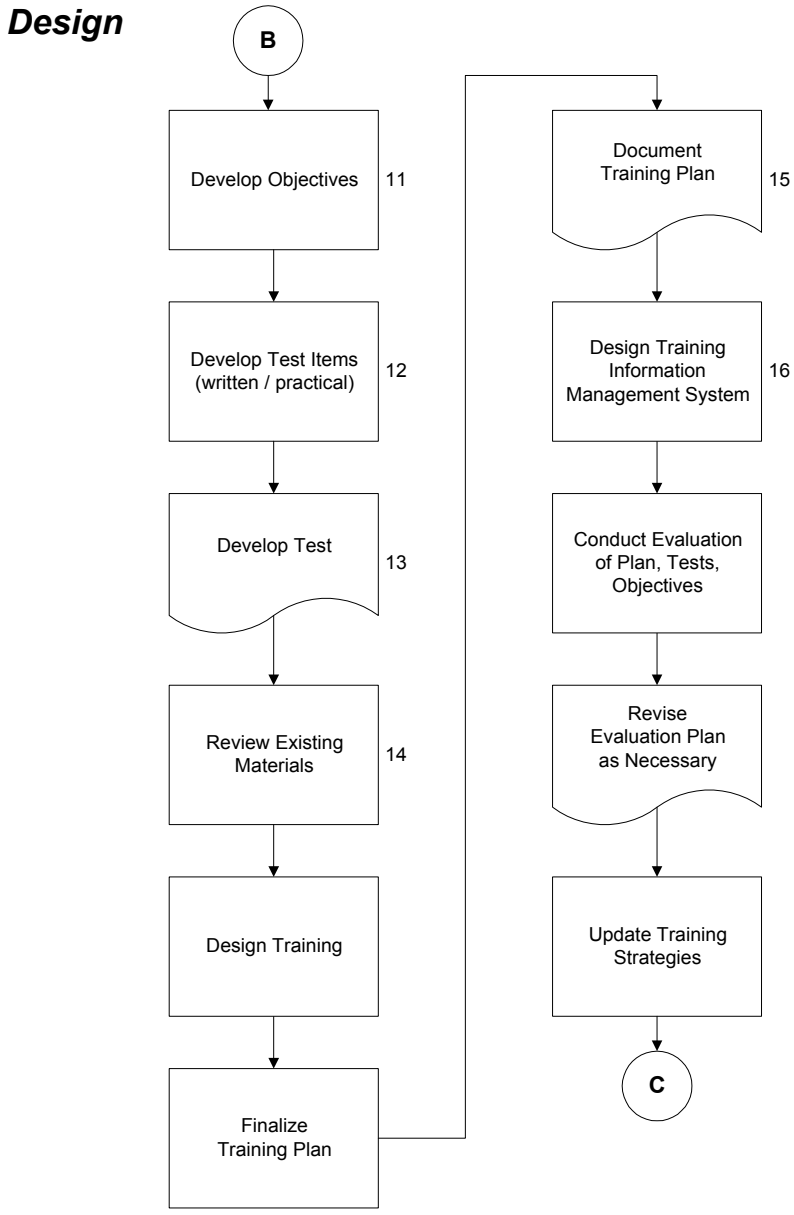
Describe the elements of training design.
Explain the process of designing training.
Discuss the design phase planning activities.
Describe the quality improvement functions in the design phase.

Where to read about it

This chapter contains eight sections.

Design process flowchart

The design portion of the training development flowchart (Figure 7) is provided below as a quick reminder of the activities involved in the design process. As a reminder, the numbers on the flowchart represent the design activities where the Technical Training Management System (TTMS) can help support the ISD process.



Section A
Develop Objectives

Introduction

One product of the analysis phase was a list of tasks that require training. In the design phase, you use this task list and the task analysis to develop objectives for the course. Objectives should be stated in terms of what the students must be able to do at the end of training.

What it is

An objective is a precise statement of the learned capability, skills, knowledge or attitudes (SKA), a student is expected to demonstrate, the **condition** under which the SKA is to be exhibited, and the **standard** of acceptable performance upon completion of training.

Purpose

Objectives serve several purposes. Some examples are shown below.

For Instructional Developers	For Students
Serve as the building blocks for training. Provide a basis for test development. Allow for selection of the most appropriate training strategies.	Direct attention to the important content. Communicate standard of performance expected following the training. Serve as a self-check for progress.

Other terms for objectives

Sometime in your career as an instructional developer, you will likely hear objectives called:

Performance objectives.
Behavioral objectives.
Instructional objectives.
Training objectives.
Criterion objectives.
Knowledge objectives.

Regardless of what they may be called, they are the same.

Parts of an objective

Most objectives have three parts:

Condition
Learned Capability (Behavior)
Standard

Each part of the objective will be discussed in detail later in this section under "Characteristics of Objectives."

Levels of objectives

Many terms have been used to describe the levels of objectives. You may see some of the following terms used to distinguish the levels:

Terminal
Primary
Enabling
Secondary
Supporting
Subordinate

This handbook will refer to the different levels only in order to show the hierarchical relationship of objectives.

Examples of objectives

Several examples of objectives are:

Given the length of one side of a cube, compute the exact surface area.
Using a multimeter and schematic diagram, measure the resistance of a series circuit with no more than 5% error.
Without reference, list the principles of leadership as defined in the Air Force Leadership Handbook.

Where to read about it

This section covers four topics.

Additional information

For additional information on objectives, see:

Davies, I. K. (1976). *Objectives in Curriculum Design.* London: McGraw Hill.

Kibler, R. J. (1981). *Objectives for Instruction.* Boston: Allyn and Bacon.

Mager, R. F. (1962). *Preparing Objectives for Instruction* (2nd Ed.). Belmont, California: Fearon Publishers.

Characteristics of Objectives

Introduction

Before starting to develop objectives, you should become thoroughly familiar with each part of an objective. Familiarity with the different parts will enable you to develop better objectives, and thus, better training. Objectives should be worded carefully so that all readers or listeners have the same understanding.

Where to read about it

This topic is divided into three parts.

Condition

Introduction

A thorough understanding of the **conditions** will help you develop more effective objectives. Whenever possible, the condition specified in an objective should be the same as the actual conditions under which the job is performed. For example, if a particular piece of test equipment or a specific technical order is required to perform a task, it should be identified as a condition in the objective.

What it is

A **condition** identifies the situation under which a student is expected to demonstrate a behavior. A properly prepared objective clearly states the limits or conditions of student performance. A condition may specify:

If the student can use technical orders.
If the student is allowed to use a checklist.
The tools/test equipment a student is allowed to use.
If students can use notes they have taken during instruction.

Things to consider

When determining the conditions for the objectives, consider that:

Conditions should specify the objects, events, human behavior, words, or symbols that will be presented to the students. Conditions under which the training is performed should be the same as the actual job conditions, if possible.

Examples of conditions

Condition statements can be derived from the task analysis. The following are some examples of conditions.

Examples of Condition Statements
"Given the diameter of a sphere and the formula, compute the . . ."
"Using a calculator and debit worksheet, calculate the . . ."
"Using a multimeter and schematic diagram, measure . . ."
Without reference, list the principles of leadership . . ."
"Under conditions of total darkness, field-strip . . ."

Learned Capability (Behavior)

Introduction

The capability part of the objective states what a student will do to demonstrate that he/she learned a specific skill, knowledge or attitude. The capability must be written in measurable, observable terms so that student performance can be objectively evaluated. As an instructional developer, you should learn to write the capability part of an objective so that the tasks to be taught are clearly stated so that everyone – students, instructors, and developers – know exactly what must be learned by the students.

What it is

A capability (behavior) is defined as an SKA that is observable and measurable.

Things to consider

When stating the capability in an objective, use action verbs to reduce ambiguity. Action verbs are observable and measurable while ambiguous verbs are not. The following table provides some examples.

Action Verbs	Ambiguous Verbs
Troubleshoot Repair List	Understand Know Learn

Examples of learned capability

The following are some examples of learned capability statements.

Examples of Learned Capability Statements
". . . the formula, compute the exact surface of the sphere."
". . . debit worksheet, calculate amount owed from the last quarter . . ."
". . . diagram, measure the resistance of a series circuit . . ."
". . . reference, list the principles of leadership."
". . . total darkness, field-strip and reassemble an M-16 rifle . . ."

Standard

Introduction

The final part of a well-prepared objective is a clearly stated standard of performance. The student's performance will result in an output; the quantity or quality of which is the standard of performance. When you were gathering information to build the task analysis list, you probably found many of the tasks had standards of performance specified. However, if no standards have been set, you will be required to set standards based on other sources such as experience or similar tasks. You will likely need to "refine" the standards after they have been verified against on-the-job performance.

What it is

A **standard** defines the criteria for acceptable performance by the student. It is stated in terms such as completeness, accuracy requirements, time constraints, performance rates, and qualitative requirements. It identifies the proficiency the students must achieve when they perform the behavior under the specified conditions. Without a standard, it is impossible to determine when the students have achieved the objective.

Types of standards

Standards can be classified in one of the following types.

Type of Standard	Examples
Standard operating procedure	". . . will comply with AFRs and local regulations."
"No error"	". . . compute the exact surface area of the sphere."
Minimum acceptable level of performance	". . . compute the answer to the nearest tenth."
Time requirement	". . . minimum speed of 35 words per minute."
Rate of production	". . . at a minimum of 20 units per day."
Qualitative requirements	". . . to idle smoothly . . ."

Examples of standards

The following are some examples of standards.

Examples of Standard Statements
". . . compute the exact surface of a sphere." **(without error implied)**
". . . owed from last quarter **to the nearest dollar.**"
". . . measure the resistance of series circuit **with no more than 5% error.**"
". . . principle of leadership **as defined in Air Forces Leadership Handbook."**
". . . field-strip and reassemble an M-16 rifle **within 15 minutes.**"

Guidelines for Developing Objectives

Introduction

To this point, background information and the three components of an objective have been discussed. Now, you are ready to develop objectives. The first thing you need in order to develop objectives is the list of tasks (task worksheet) that you developed during task analysis. Using the information on the task list, what you have learned about objectives to this point, and a few guidelines, you will be able to develop effective objectives.

Guidelines for developing objectives

Several guidelines for developing objectives are provided below.

Note: Always consider cost and safety constraints.

Type	Guidelines
General	Use task descriptions developed during the analysis phase. Analyze each task or knowledge item on the task list to determine the number of objectives that are required for each item. Document each objective on a worksheet. Use learning analysis results to assign skills and knowledge to support each objective and subobjective. Document results on worksheet.
Condition	Select conditions that match job conditions as closely as possible. Ensure that conditions are realistic.

Guidelines for developing objectives (Continued)

Type	Guidelines
Learned Capability (Behavior)	Ensure that behavior is the same as that required on the job, if possible. State the behavior in terms that everyone understands. Use an action verb to describe the desired behavior. Don't use behaviors such as "know," "understand," etc. Use behaviors that are: Observable Measurable Reliable Verifiable
Standard	Use a standard that meets job performance requirements, if possible. Use a standard that is clear and understood by everyone. Use a standard that accurately measures student achievement of the objective. Ensure that the standard is complete. Ensure that the standard is accurate. Ensure that the standard is achievable.

Hierarchy of Objectives

Introduction

Most tasks are made up of steps and procedures; however, there are also non-procedural tasks. Students need to learn each of these steps or procedures before they can perform a particular task. In other words, you need to specify objectives for those steps or procedures, in addition to the task itself. These different levels of objectives can be structured into an objective map that depicts the relationship of various objectives and their sequence. This map is called objective or learning hierarchy.

Purpose

The purpose of the objective hierarchy is to depict the relationship of objectives so that the most effective and efficient learning sequence can be developed.

Classification of objectives

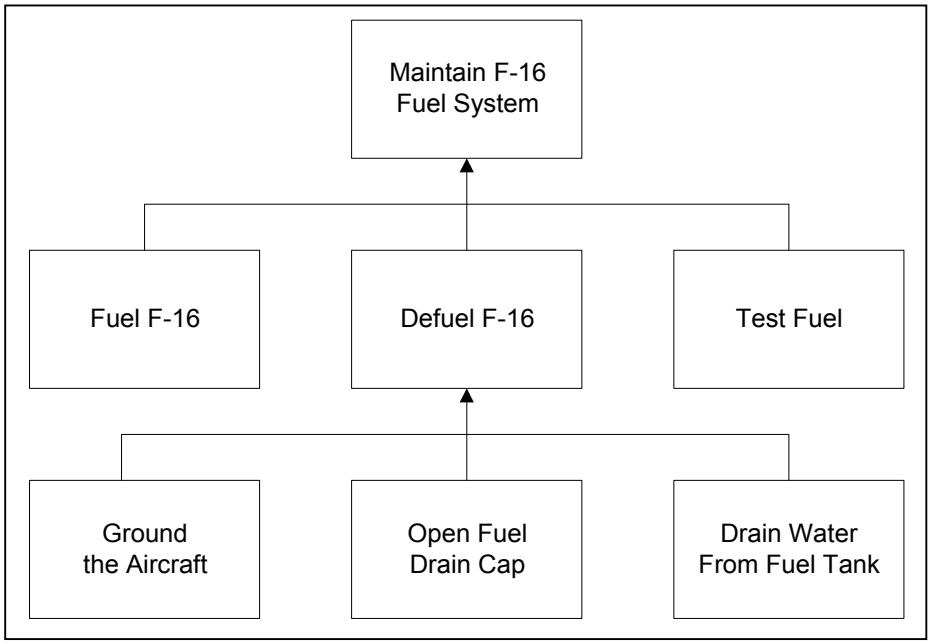
Objectives can be classified into two categories, as shown below.

Category	Description	Other Names
Terminal	An objective that learners will be expected to accomplish when they have completed the instruction. It may contain several enabling objectives.	Primary Main End
Enabling	An objective those learners must attain in order to accomplish a terminal objective.	Secondary Supporting Subordinate

Example of objective hierarchy

Figure 12 is an example of an objective hierarchy. "Maintain F-16 Fuel System" is the terminal objective and the others are enabling objectives.

Figure 10 Objective Hierarchy



Prioritizing, Clustering, and Sequencing Objectives

Introduction

The effectiveness and cost-efficiency of a course will depend in part on how well you prioritize, cluster, and sequence the objectives. Guidelines for prioritizing, clustering, and sequencing objectives will be provided in this portion of the section. Also, additional information on clustering and sequencing objectives can be found later in this chapter in the section on designing training activities.

Prioritize objectives

Prioritizing objectives may not be required in all training development projects. However, as the Air Force's budget continues to shrink, it may be necessary to prioritize the objectives in order to provide the training that is most needed by the MAJCOMs (users).

For example, a 25-day course is required to teach a particular set of objectives. However, due to student allocation constraints, you can only develop a course that is 20 days in length. To reduce the course length by five days, it is necessary to determine which objectives are less critical and can be eliminated from the course.

Guideline

Have the user prioritize the line items in the training standard. Then the objective can be prioritized to meet the user's need.

When should you prioritize?

If you expect that you may not be able to provide the needed training due to resource constraints, you should request that the user prioritize the training standard line items during meetings such as the Utilization and Training Workshop (U&TW) or Training Planning Team (TPT). Another way is to have the user prioritize requirements during training standard coordination.

Who is responsible?

The users are responsible for determining the priority of their training needs. If they can't reach a consensus, then the AF functional manager for that specialty sets the priority.

Clustering objectives

The purpose of clustering or grouping objectives is to develop logical and meaningful portions of training such as units, lessons, or segments. When clustering objectives, use the following guidelines.

Cluster objectives that are common prerequisites to other objectives. For example, basic electronic skills and knowledge may be required for many tasks in a course; therefore, they may be clustered in the same unit and taught in the core training.
Cluster objectives that are related to the same system or engage the same type of action. For example, all tasks related to the maintenance of a particular piece of navigation equipment may be clustered into a unit.
Cluster objectives with common skills and knowledge. For example, some maintenance tasks require identical skills and knowledge across different systems, such as computer maintenance or aircraft refueling.
Cluster objectives with potential for the same training method or delivery system. For example, you can cluster knowledge objectives utilizing the lecture method while clustering skill objectives taught by demonstration/performance. Also, objectives with the same type of learning may be clustered to facilitate training such as classroom and equipment.

Sequencing of objectives

A curriculum or course requires decisions about the sequencing of objectives. The goal of good instructional design is to establish sequences within courses that promote effective learning. The sequence and lessons within a course should be based on the prerequisite relationship among the objectives. The most obvious sequence follows the order from simple to complex or from general to specific. The table below summarizes the major considerations regarding sequential arrangement within a topic for each type of learning outcome.

Sequencing of objectives (Continued)

Type of Learning Outcome	Major Principles of Sequencing	Related Sequence Factors
Intellectual Skills	Presentation of learning situation for each new skill should be preceded by prior mastery of subordinate skills.	Verbal information may be recalled or newly presented to provide elaboration of each skill and conditions of its use.
Cognitive Strategies	Learning and problem-solving situations should involve recall of previously acquired relevant intellectual skills.	Verbal information relevant to the new learning should be previously learned or presented in instructions.
Verbal Information	For major subtopics, order of presentation is not important. New facts should be preceded by meaningful context.	Prior learning of necessary intellectual skills involved in reading, listening, etc., is usually assumed.
Attitudes	Establishment of respect for source is an initial step. Choice situations should be preceded by mastery of any intellectual skills involved.	Verbal information relevant to choices should be previously learned or presented in instructions.
Motor Skills	Provide intensive practice on part skills of critical importance and practice on total skill.	First of all, learn the executive subroutine (rule).

Source: Gagné, M. R., Briggs, L. J., and Wager, W. W. (1992). *Principles of Instruction* (4th Ed.). New York: Harcourt Brace Jovanovich College Publishers.

Section B
Develop Tests

Introduction

After you have specified the objectives for the course, the next task is to develop tests to assess the student's attainment of the objectives. To ensure that tests adequately measure the objectives, the performance required in the test should match the performance required in the objective. You should develop tests immediately after the objectives have been written.

Purpose

The primary purpose of testing is to assess the student's attainment of the behavior specified in the objective. Tests can also serve several other purposes such as:

Identify and correct problems or weaknesses in the training.
Indicate whether a class is performing up to standards on specific objectives.
Indicate instructor proficiency.

Criterion referenced testing

The Air Force measurement program is based on the concept of criterion-referenced testing (CRT). (In some training communities, the term "sampling testing" is used instead of "criterion testing.") Sampling tests measure knowledge objectives and knowledge components of performance objectives in sufficient quantity to provide an acceptable degree of confidence that the students have attained the required knowledge. The students must successfully achieve a minimum overall passing score. Individual students are measured against the standards specified in the objectives. To attain an objective, the student must meet or exceed the standard specified in the objective. The criterion test is basically a pass/fail type of test.

Types of tests

The basic types of tests used in the Air Force are described below.

Category of Test	Purpose of Test
Criterion	Used to measure the student's attainment of the objective. Used to measure the effectiveness of the instruction.
Pretest	Used to measure the student's ability to attain each objective. Used after the instructional system becomes operational to determine how much instruction individual students need. **Diagnostic** Used to determine attainment of supporting skills and knowledge necessary to perform the terminal objective. Used during validation to predict success, to identify and correct weaknesses in the instruction. **Survey** Used to determine what prospective students already know and can do before receiving instruction. Used during development of instruction to gather data for design of instruction.

Characteristics of tests

There are several characteristics to be considered when developing tests. These characteristics ensure that the tests measure what is intended each time they are administered. The characteristics are shown in the following table.

Characteristic	Definition
Validity	**Content** Degree to which the test measures what it is intended to measure. **Predictive** Degree to which the test predicts performance.
Reliability	Degree to which the test yields the same results consistently. **Test-Retest** Consistency across two administrations to the same students. **Split-halves** Consistency across two forms of the same test.
Usability	Tests that are easy to administer, score, and interpret.

Assessment method

Most Air Force tests can be classified into two main groups: predictive and performance tests. A common question is: When should designers use performance tests and when should they use paper-pencil tests? These are the wrong categories for comparison. The comparison should really be between performance tests and predictive tests.

Performance test

A performance test is one in which the student actually performs the skill required by the terminal objective. If the objective of the lesson is to recall information, then a test where the student has to recall the information by writing it on a piece of paper is a performance test. Many concept and rule-using type performances are tested with paper-and-pencil tests. For instance, many problem-solving skills involving the use of scientific principles can be observed from written performance tests.

Performance test (Continued)

Many types of tasks, especially equipment operation tasks, involve many different capabilities that have to be performed in an integrated manner. For example, the task of bleeding a hydraulic brake system involves recall of a procedure (information learning), physical performance of the steps (motor performance), recognition of the parts and tools (concepts), observation of the brake fluid conditions in the system (rule using), and attitudes (cleanliness and safety). In these types of tasks, performance cannot be measured by a paper-and-pencil test. A performance test would require a real or operational mock-up of a brake system. Because performance tests require the student to demonstrate mastery of the task previously learned, they are said to have content validity. The most content-valid test of any kind of learning is a performance test.

Predictive test

Performance tests of integrated tasks are generally time-consuming because they often have to be conducted one-on-one with real equipment or simulators. If the actual behavior cannot be tested in a performance test (because it is too costly, dangerous or impractical), the next best option is to test the behaviors that enable performance of the desired skill. From that information make a prediction as to whether the student would be able to perform the task. For example, if a student could write the steps for bleeding a brake system, there is a better probability that the student could actually perform the task than someone who didn't know the steps. Tests that do not test the actual behavior, but test component or related behaviors, *are valid to the extent that they predict student performance on the actual task*.

Comparison of performance and predictive tests

In the past, most predictive tests were written paper-and-pencil type tests, because they are easy to produce, administer and score. The most common types of written test questions are essay, short answer, fill-in-the-blank, labeling, multiple-choice, matching, and true-false. Today's media provide other testing options. Computers provide different types of input systems that can have a high degree of fidelity with real-world tasks. Even a simple input device such as a joystick or a mouse allows for identification by pointing with a cursor. More elaborate devices

Comparison of performance and predictive tests (Continued)

such as magnetic field detectors, infrared detectors, etc., allow the computer to detect even more complex behavior.

How does an instructional designer decide what type of test to construct or what type of item to use? The best type of test is one that gives the decision-maker the best information regarding the student's mastery of the objective. Different types of test items have advantages and disadvantages with regard to good test construction. These advantages and disadvantages have to be considered in terms of validity and reliability of the test.

Predictive Test Item	Performance Test Item
Requires students to demonstrate knowledge by responding to various types of written questions.	Requires students to accomplish a job-like task under controlled conditions.
Emphasizes verbal or symbolic aspects.	Emphasizes nonverbal aspects.
May require students to find, read, and use technical materials.	May require students to find, read, and use certain technical material (job aids, for example).
Items are knowledge the student should learn to perform or make decisions on the job.	Items are skills that students should perform, or the decisions they may make on the job.
Items are independent questions, not dependent on sequence.	Items are dependent on sequence in which they are presented.
Errors on one item should not affect performance on another item.	Errors early in the sequence may affect final outcome of the task.

Test construction factors

Several key factors should be considered when constructing tests.

What to measure. Analysis of objectives should identify what should be measured. To determine what to measure, list the tasks to be performed or objective statement to be covered by the test. One or more test items may be needed to adequately

Test construction factors (Continued)

measure each objective. Tests should measure application of principles, knowledge of factual information, ability to perform task, and transfer of knowledge and skills to solve similar problems.

Testing level. The level of testing (know, comprehend, etc.) should correlate with the stated level of learning for that portion of the instruction being tested – no higher and no lower.

Test length. Adequate coverage of the objective is the major factor in determining the length of test that is required. Longer tests are normally more reliable since they usually cover the material better.

Selection and arrangement of test items. Select test items that cover the most essential and significant portions of the material. Test items selected should be clear, concise and well written to minimize misunderstandings. Items of the same type should be grouped together in a test, if possible. Individual test items should also be arranged in approximate order of difficulty, which allows the students to progress as far as they can without spending excessive time on difficult items at the first part of the test.

Procedures to develop written test items

When developing written test items, follow the steps provided below.

Steps To Develop Written Tests	
Step 1	Determine the test format and the number of items per objective.
Step 2	Generate test items.
Step 3	Arrange test items (logical, simple-to-complex, and procedural).
Step 4	Write directions for the test administration.
Step 5	Review the test for accuracy and completeness.
Step 6	Publish the test in adequate copies.

Multiple Choice

Multiple choice tests are probably the most used type of written tests. They test recall, problem-solving skills, application of facts and principles, and understanding. A multiple choice item consists of a stem (a question or uncompleted statement), a correct response, and distractors (incorrect responses).

Example

Directions: Carefully read the questions or statements below and circle the correct response. There is only one correct response.

1. Hydraulic systems using mineral base fluids are flushed and cleaned with:

a. Alcohol
b. Kerosene
c. Soap solution
d. Carbon tetrachloride

Construction Guidelines

Do not use the articles "a" and "an" at the end of the stem; this tends to indicate the correct answer.
All responses should follow grammatically from the stem.
All responses should be of approximately the same length.
All responses should have a similar grammatical structure.
All responses should use similar terminology.
Provide as many responses as necessary but normally four.
Position the correct response randomly throughout the test.
Limit the use of responses such as "none of the above" or "all of the above."
Ensure that there is only one correct answer.
Distractors should be plausible but incorrect.
Responses should be arranged in order so they increase or decrease in length.

Multiple/Multiple Choice

These are sometimes referred to as "K-type" questions. Multiple/multiple choice questions are used when there are multiple correct responses possible. A broad scope of information can be covered within a single question, thus increasing the complexity and difficulty of the question.

Example

Directions: For question 8, SELECT:

a. if only 1, 2, and 3 are correct.
b. if only 1 and 3 are correct.
c. if only 2 and 4 are correct.
d. if only 4 is correct.
e. if all four are correct.

8. Which of the following possess(es) a clearly established relationship as a risk factor for coronary artery disease?

1. High stress
2. Tobacco use
3. Alcohol use
4. Hypertension

Construction Guidelines

Group all of the questions of this type together on a test so directions can be given once for several questions.
Provide clear directions on the choosing of the correct answer.
Use singular/plural verbs in stem to prevent grammatical cues to the correct response.
Use direct questions that end with question marks.
Use four responses.

True/False

A true/false test should be used sparingly since the chance of random guessing is high. True/false tests may be used when you want a student to identify a completely true or completely false statement.

Example

Directions: Carefully read the question below and circle true or false to indicate the correct response.

True False 1. When cleaning solvents are being used, it is extremely important to provide adequate ventilation.

True False 2. A good mechanical connection helps ensure a good electrical connection.

Construction Guidelines

Include only one idea in each statement.
Place the crucial element at or near the end of the statement.
Avoid using negatives such as "no" or "not." They tend to confuse students.
Do not use absolutes such as "all," "every," "none," and "never."
Do not use statements containing "some," "any," and "generally."

Matching

A matching test is used to measure a student's ability to identify and discriminate among related or similar items. Matching items normally use two columns of related items, and students are required to match a series of items listed in one column with related items in the other column. It provides a way to test multiple knowledge simultaneously. An example is provided on the following page.

Matching (Continued)

Example

Directions: Listed in the two columns below are words and phrases. Select the phrase in the right-hand column that defines the word in the left-hand column and place the identifying letter in the blank space provided. Some of the phrases may be used more than one time, while others may not be used at all. The first item is answered as an example.

1 - 5	
_c_ Validity	a. Detects small differences in the mastery of the subject matter.
___ Reliability	b. Determines the ease of administering, scoring, and interpreting test results.
___ Objectivity	c. Measures what it is designed to measure.
___ Comprehensiveness	d. Includes a proportional number of test items on all lesson objectives.
___ Differentiation	e. Yields consistent results every time it is given.
___ Usability	f. Is often determined by correlating the original test scores with those obtained in a retest.
	g. Yields test scores that are not influenced by bias or personal opinion of the score.
	h. Is assumed to be present when a job is learned to a high level of proficiency within a reasonable time.

Matching (Continued)

Construction Guidelines

Provide clear, concise directions on how to match the items in the two columns.
Indicate whether the responses may be used more than once.
Limit test items to a single area and choices to a single subject category.
Arrange the responses in the same logical order.

Completion

A completion test item requires the students to recall and supply one or more key words that have been omitted from the statement. When placed in the appropriate blanks, the word(s) make the statement complete, meaningful, and true. An example is given below.

Example

Directions: Complete the sentences below by adding the correct word(s) in the blank spaces provided.

1. Good _____ connections help to ensure a good _____ connection.

2. A test item consisting of a sentence or statement from which a word or phrase is omitted is called _____.

Construction Guidelines

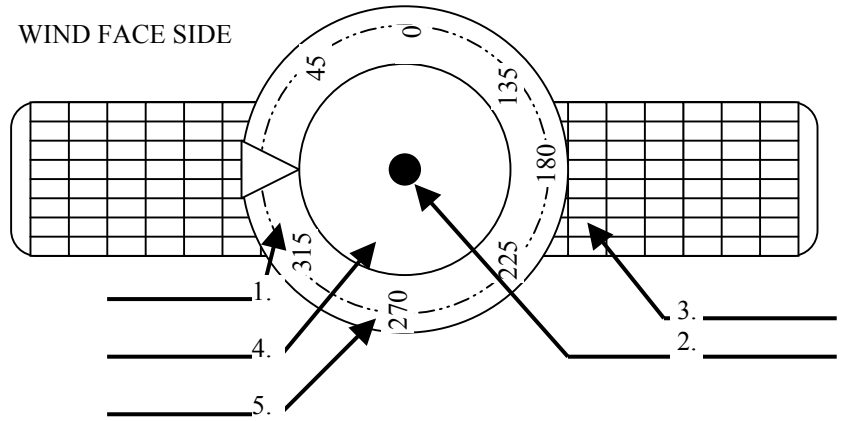
Leave blanks for key words only.
Keep items brief.
Make all blanks approximately the same size.
Grammatical cues to the correct answer, such as the articles "a" and "an" just before the blank, should be avoided.
Ensure that only one correct answer is possible for each blank.

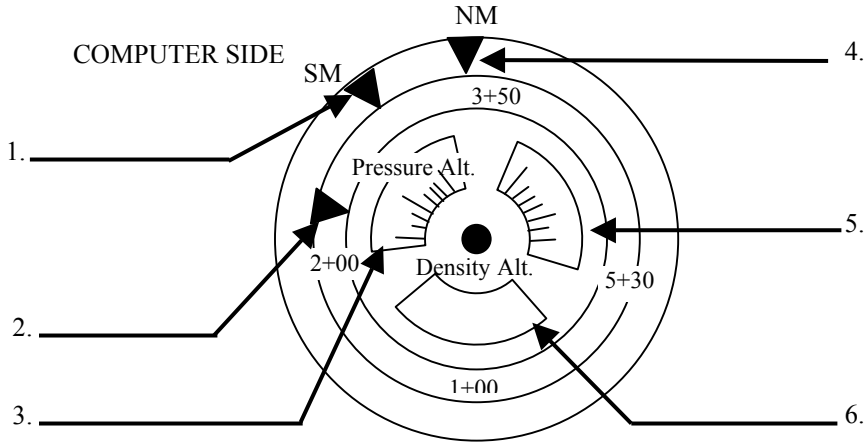
Labeling

Labeling or identification tests are used to measure a student's ability to recall and label parts in pictures, schematics, diagrams, or drawings. This form of testing is most often used to measure recognition of equipment components or other concrete objects.

Example:

Directions: Identify the numbered items of a CPU-26 computer. Place the correct answer in the space provided.





Continued next page

Labeling (Continued)

Construction Guidelines

Make all sketches, drawings or illustrations clear and of sufficient size. If possible, use the actual parts of a unit.
Provide sufficient information to indicate what the equipment is and which part is to be labeled.
The parts to be labeled or identified should be clearly pointed out by using lines or arrows.
Ensure that only one definite answer is possible.

Essay

An essay test, which is not normally used in technical training, requires a more or less extensive discussion by the student. It should be used only when the students are expected to think reflectively or creatively, to organize knowledge in the solution of a problem, and to express their solution in writing.

Example

Directions: Complete the essay question in 500 words or less. Use only one side of the paper to write your response**.**

Test Item: Describe how the ISD process applies to development of technical training.

Construction Guidelines

State the essay item clearly so the student knows exactly what type of discussion is expected.
The essay item should ask for comparisons, decisions, solutions, cause-effect relationships, explanations or summary.
When possible, use more essay items and limit the discussion on each.
Set limits on essay questions such as time or number of words.

Procedures to develop performance tests

When developing performance tests, follow the steps provided below.

Steps to Develop Performance Tests	
Step 1	List steps/activities/behaviors (process) or characteristics (product).
Step 2	Note common errors that are made when using the checklist.
Step 3	Arrange the activities or steps and characteristics in correct order.
Step 4	Review the checklist for accuracy and completeness.
Step 5	Publish the checklist in adequate quantities.

Constructing performance test/checklist

Performance tests, which require the student to perform a task, usually have the format of a checklist. The checklist is developed to correspond to the steps or activities of the task being performed. During the performance test, an evaluator observes the student performing a series of steps or activities while rating the steps on a checklist (process evaluation). An evaluator may also rate the end product of a performance on a checklist (product evaluation).

Performance test using a process checklist

When a performance test requires the steps or activities to be rated, a process checklist is used. The process checklist should contain all of the essential steps or activities required for successful performance.

Example

PROCESS CHECKLIST: INSTALL RESISTOR ON CIRCUIT BOARD		
Check	**Step or Activity**	**Description of Error**
	1. Prepare the soldering iron.	
	2. Mount the circuit board in the jig.	
	3. Select the proper resistor.	
	4. Install resistor on circuit board.	
	5. Solder resistor leads.	

Performance test using a process checklist (continued)

Guidelines for Construction and Use

Use when the performance of steps or activities of a task is to be evaluated.
The steps or activities must be observable.
Define all of the steps or activities of the task being performed.
Sequence steps or activities in order of performance.
Provide space for "checking" the performance of each step or activity.
Provide space for recording and describing errors.

When a performance test requires the product of a process or task to be evaluated, you will likely want to use a product checklist. The product checklist should identify criteria or characteristics of product acceptability.

Example

PRODUCT CHECKLIST: INSTALL RESISTOR ON CIRCUIT BOARD			
Yes	**No**	**Product Criteria/Characteristics**	**Comments**
		1. Is the value of the resistor correct?	
		2. Is the resistor correctly mounted on the circuit board?	
		3. Is the soldering iron properly tinned?	

Guidelines for Construction and Use:

Use checklist when the objective requires the student to produce something.
Use checklist when the product can be readily evaluated.
Use checklist when there are no fixed or set procedures.
Identify the characteristics of the product.
Provide space on the checklist for product rating.
Provide space on the checklist for comments about the product.

Test review and analysis during summative evaluation

Review and analysis of tests or measurement devices during the summative evaluation process ensures that they measure what they are supposed to measure. Normally, data from the first several administrations (classes) of the test will provide sufficient data to complete the summative evaluation process. However, if the development team is not confident that adequate data has been collected, the summative evaluation process can be extended until the necessary data has been collected.

During the summative evaluation period, it is suggested that data be collected and analyzed after each administration of the test. Analysis of the data should identify any potential problems with the testing instrument. For example, if a test item is a high-miss (usually 50 percent or more) or students fail to perform the specified task within the prescribed time limit, the item should be analyzed to determine if there is a problem. Analysis may identify a problem with the test item or it could be that the instruction being provided does not adequately cover the objective that the test item is to measure. Regardless of the source of the problem, action should be taken to correct any identified problem to ensure quality of process and products of the summative evaluation process.

Once the summative evaluation process has been completed, which includes test validation, the instructional system is then placed into operational status. Once the system is operating under normal conditions, curriculum developers or the instructional staff should periodically review and analyze the composite data resulting from all administrations of the tests since the instructional system became operational or since the last time the test data was analyzed.

It is suggested that the frequency of test data analysis be based on the number of times the test is administered (student flow through the course). However, if student flow through a course is low, it is recommended that a composite of the test data results be analyzed at least once each year. It should also be noted that the number of versions of a particular test will impact the frequency of test data analysis since the time between administrations of a particular test version increases with the number of test versions.

Test review and analysis during operational evaluation (Continued)

The review and analysis during this period is part of the operational evaluation process that ensures the continuing quality of the instructional system under normal operating conditions.

As with test item analysis during the summative evaluation process, all test items should be analyzed to determine if there are any possible problems or trends with any of the test items. For example:

Are there any items on the test that are always low-miss? There are test items such as security and safety that should normally be low-miss items.
Are there any items on the test that are always high-miss? Are most students having difficulty completing a particular performance task?

Any test item identified as a potential problem should be analyzed and the appropriate corrective action should be taken.

Additional information

For additional information on test development and analysis, see:

AFMAN 36-2236, Handbook for Air Force Instructors.
Shrock, S. and Coscarelli, W. C. C. (1990). *Criterion-Referenced Test Development*. Reading, Massachusetts: Addison-Wesley Publishing Company.
Swezey, R. W. and Pearlstein, R. B. (1975). *Guidebook for Developing Criterion-Referenced Test*. Arlington, Virginia: U.S. Army Research Institute for the Behavioral and Social Sciences.

Section C
Review Existing Materials

Introduction

Developing training materials can be expensive and time-consuming. Therefore, after developing objectives and tests, review existing training materials to determine if materials exist that will support course objectives. If materials are found, it is possible that they will not totally support the objectives. If so, don't hesitate to modify the material to fit your need.

Benefits

Using existing materials saves time, human resources, materials, and money.

Sources of existing materials

Existing training materials may be obtained from:

DoD
Other services
Other federal agencies
Commercial/industrial organizations
Colleges and universities

Types of existing materials

When reviewing existing training materials, you may find them in one of the following forms:

Printed materials (e.g., textbooks, publications, technical orders, job aids)
Slides
Video
Audio cassettes
Computer-based (ICW, CAI)
Training aids

How to select materials

To standardize the process and allow comparison between materials under review, you may use the following job aids to help select existing materials.

Job Aid for Existing Material Reviews	
	Yes/No
Do test items measure the objectives? Does the material meet the requirements of the objective(s)? Is the difficulty level of the material appropriate? Is the material accurate? Is the material current? Does the material motivate students to learn? Is the material properly sequenced? Does the material provide sufficient instructional guidance? Are sufficient practice exercises provided? Is the material proprietary or copyrighted?	

How to select materials (Continued)

Job Aid Existing Material Review Form

Evaluator:_____ Date:_____

1. Objectives the material supports:_____

2. Type of Media:_____

3. Evaluation of Material	Poor		Good		Excellent
Content					
Accuracy	1	2	3	4	5
Currency	1	2	3	4	5
Level	1	2	3	4	5
Structure					
Organization	1	2	3	4	5
Sequence	1	2	3	4	5
Suitability					
Supports Objective	1	2	3	4	5
User-friendly	1	2	3	4	5
Pace	1	2	3	4	5
Guidance	1	2	3	4	5
Feedback	1	2	3	4	5
Motivational	1	2	3	4	5
Measurement	1	2	3	4	5

4. What do I like about the material?

5. What do I dislike about the material?

6. Can the material be modified to improve its utility? If so, what should be done?

Modifying existing materials

Sometimes you may find that existing material is available for use but it needs modification. When modifying existing materials, you may:

Add new materials such as information on the operation of a particular piece of equipment that was not covered in the existing material.
Expand existing materials to include more detailed information, diagrams, illustrations and examples.
Delete materials that do not support the objective(s).
Update material to include the most current information such as revised procedures and data, and to correct inaccuracies.
Resequence material to make it compatible with the training design.

Additional information

For additional information on reviewing existing materials, see:

Dick, W. and Carey L. (1990). *The Systematic Design of Instruction* (3rd Ed.). Glenview, Illinois: Harper Collins Publishers.
Knirk, F. G. and Gustafson, K. L. (1986). *Instructional Technology: A Systematic Approach to Education.* New York: Holt, Rinehart, and Winston.

Section D
Design Training

Introduction

If you cannot find any existing material that fits your needs, proceed to design your own training. Your design determines the effectiveness and cost-efficiency of the training system. Training design should be determined by what best meets the training needs rather than just using a particular training design that has always been used in your training organization.

Where to read about it

This section covers four topics.

Determine Training Strategies

Introduction

After the objectives and related tests have been developed and you know what behavior must be shaped, you should plan and develop the most effective and cost-efficient learning environment using the principles of learning. This process starts by determining the training strategies or plan you intend to use. A training strategy is necessary in order to manage the design of the training activities and the learning process. Selection of the instructional strategy needs to be consistent with the prior learning analysis and objectives hierarchy decisions. It also needs to support the instructional aims and overall instructional concept.

Determining training strategies

Training strategies can be determined from the following four issues:

- Student participation
- Student feedback
- Student pacing
- Training sequence

Student Participation

Active student participation is essential for learning to take place. Students learn by doing, thinking, and feeling through answering questions, discussing, computing, manipulating, and putting ideas together. The training strategy ensures that students are active in the learning process and can apply or demonstrate what they have learned. Learning is a process in which students gain skills and knowledge, and shape attitudes through their own activities, experiences, and motivations. For each type of learning, consider using the following strategies.

Determining training strategies (Continued)

Types of Learning	Training Strategies
Skill	Demonstrate task that the student is to perform. Have each student do each step of the task following the demonstration. Have each student perform the entire task with minimum guidance.
Knowledge	Provide drill and practice to reinforce recall. Use examples and non-examples to reinforce understanding. Provide opportunity to practice the knowledge in context.
Attitude	Use human modeling to shape student attitude. Use guided discussions for affective lessons. Give or withhold rewards.

Student Feedback

Students participating in the teaching/learning activity will need feedback on how well they are doing. Feedback not only informs the students on how well they are doing, but also serves as a valuable source of motivation. The training strategy should provide each student with feedback, whether it is the results of a written test or instructor comments during the performance of a task. Ask frequent questions and provide feedback to address any possible student misunderstanding about the content.

Determining training strategies (Continued)

Student Pacing

Pacing is the rate at which students go through the training. There are several ways to pace students' progress.

Self-Paced – Students are allowed to work at their own pace through the training within certain parameters. This form of pacing is very effective in courses using CBT, interactive video and self-study.

Group-Paced – Students progress through the training together as a group, at the same rate. This is a very effective pacing method when training large numbers of students. However, it does not allow individuals to deviate from the group rate.

Group Lock-Step – The group progresses through the training at a predetermined pace, completing training on schedule. Normally, this is the most costly form of pacing. However, in cases where the group's pace through the training is critical, it is very effective.

Combination Pacing – Any of the above-mentioned forms of pacing may be used in combination.

Instructional Sequence

The following sequence considerations also determine training strategies.

Proficiency Advancement – This technique is used to advance students who have prior knowledge, practical experience, or are exceptionally fast learners. Students show their proficiency by passing a criterion test. Students may by-pass the training in which they have passed the criterion test.

Multiple Track – A training sequence may be divided into various tracks to allow students to go through training best suited to their abilities and needs. The best track for a student is determined by a pretest.

Modular Scheduling – Training is divided into different modules and students are pretested to determine which modules of training they need. Modular scheduling is normally used only when the learning sequence is not critical.

Design Training Activities

Introduction

Design of the training activity depends largely on two factors: training sequence and the size of the training unit. Effective and cost-efficient training depends on how well you sequence and size the training.

Reasons for sequencing

Properly sequenced training provides:

Student motivation – Students learn best when they are motivated to do so. In most cases, motivation depends on a proper sense of direction. The early stages of training should provide the sense of direction to the training. Properly sequenced training will provide this direction and will give the students a "mental roadmap" of where they are going and how they are going to get there. If the students have this "mental roadmap" they are less likely to be confused, thus increasing their motivation.

Meaningful relationship – A proper sequence can provide the students with a pattern of relationships so that each training activity will have a purpose. If the training is meaningful to the students, they will learn more easily and quickly.

Consistency in content – Proper sequencing helps to avoid inconsistencies in the training content. Carefully sequenced training will eliminate gaps and duplication in the training. Consistency of content ensures that skill progression is orderly and that prerequisite knowledge and skill have been acquired prior to the introduction of advanced subject matter content or performance of more complex tasks.

Sequencing training

There are several methods of sequencing training:

Job performance order – This method sequences training in the order in which the tasks and subtasks are performed on the job. Learning tasks and subtasks arranged in this order is very effective since it is orderly in process, builds learning on learning, and adds realism to the training.

Sequencing training (Continued)

Psychological order – This method of sequencing arranges the training content based on ease of learning. Simply stated, students are taught the easier tasks first, then progress to the more complex tasks. This method also includes the process of starting with what the student already knows and proceeding to new information.
Logical order – Normally, training activities should be designed to proceed from the simple to complex or from the known to unknown. However, training activities will not always lend themselves to these design methods. In such cases, you may want to design the training activity using both the performance order and the psychological order. This arrangement normally includes the whole-part-whole concept. For example, when teaching how to assemble a carburetor, the demonstration would start with the whole carburetor. The carburetor would then be disassembled into its component parts and reassembled into the whole unit.

Guidelines for sequencing

Various methods of sequencing can be used to design training activities based on the content of the training and the availability of resources. When selecting methods to design training activities, consider the following:

Place easily learned objectives early in the training sequence.
Provide any common or "core" training early in the training sequence.
Subobjectives should be sequenced with the objective they support, when possible.
Place skills and procedures within each objective in job order, when possible.
Introduce concepts at the first point where the understanding of those concepts is a prerequisite for successful performance.
Provide training in prerequisite skills before the time when they must be combined as required on the job.
Introduce a knowledge or skill in the task in which it is most likely or most frequently to be used.
Provide practice of skills and concepts in areas where transfer of like or related skills is not apt to occur.
Place complex and cumulative skills late in the sequence.

Optimum size of training unit

There are no hard and fast rules on the proper size of each increment of training. Nevertheless, it is a very important concern for the instructional developer or design team. There is a natural tendency to "play it safe" and give more training than is necessary. This costs valuable resources and normally causes boredom on the part of the students. The best approach to designing the proper size or increment of training is to start with minimal training, and rely on validation to show if more training is needed in a particular unit or increment. This method, combined with feedback from training evaluations, will indicate the need for more training. If you provide more training than is necessary in the beginning, you will not have a good indication that you have done so.

Select Training Methods

Introduction

One of the most important tasks you will perform as an instructional developer or a member of a design team is that of selecting the training method. The method you select will have a direct impact on both the qualities of the training system and its cost-effectiveness.

What is a training method?

Training method is the process used to deliver the training content and to provide guidance for students to retain the skills and knowledge imparted. Examples include lecture, demonstration, and self-study.

Who is responsible?

The instructional developer has the overall responsibility for selecting the training method. However, in cases where the design team approach is used, team members play an active, vital role in selecting the most effective, cost-efficient method of delivering the training.

Training method options

Once the instructional developer or design team has designed the training activities, use the information to select the best training method(s) to achieve the objective. There are many training methods you can select. Some options are outlined below.

TRAINING METHODS	
Presentation methods	Presentation methods include: Lecture – A formal or semiformal oral presentation of information by a single individual; facts, concepts, problems, relationships, rules or principles presented orally either directly (as by classroom instructor) or indirectly (as by video). Demonstration – Presentation or portrayal of a sequence of events to show a procedure, technique, or operation; frequently combines an oral explanation with the operation or handling of systems equipment or material. May be presented directly (as by a classroom instructor) or indirectly (as by video).

TRAINING METHODS (Continued)	
Presentation methods (Continued)	Exhibit – A visual or print display used to present information; for example, actual equipment, models, mockups, graphic materials, displays, chalkboard, or projected images. Indirect Discourse – Verbal interaction among two or more individuals which is heard by the student; may be a dramatization, such as role playing, or a dialogue between panel members, or a teaching interview (a question and answer session between instructor and visiting "expert"). Assigned Reading – Printed verbal materials such as books, periodicals, manuals, or handouts. Reading may be course-assigned or self-assigned. Teaching Interview – Question and answer session between the instructor and visiting "expert" following a highly structured plan.
Student verbal instruction methods	Student verbal instruction methods include: Questioning – An instructor and/or courseware controlled interactive process used to emphasize a point, stimulate thinking, keep students alert, check understanding, or review material. Questioning may be direct, as by a classroom instructor, or may be designed into a film or television presentation. Programmed Questioning – An instructor and/or courseware controlled interactive process used to systematically demand a sequence of appropriate student responses; may be used directly (as by an instructor in a classroom) or indirectly (as by programmed booklets or computers). Student Query – The provision by which students are given the opportunity to search for information, as by questioning a classroom instructor, tutor, coach, or an appropriately programmed computer. Seminar – A peer-controlled group interactive process in which task- or objective-related information and experience are evoked from the students. Questions may be used to evoke student contributions, but the seminar is distinguished from questioning. Discussion – An instructor-controlled interactive process of sharing information and experiences related to achieving a training objective.

TRAINING METHODS (Continued)	
Knowledge application methods	Knowledge application methods include: Performance – Student interactions with things, data, or persons, as is necessary to attain training objectives; includes all forms of simulation (for example, games and interaction with hardware simulators) and interaction with actual equipment or job materials (for example, forms). Performance may be supervised by classroom instructor, tutor, coach, or peer to provide needed feedback. Case Study – A carefully designed description of a problem situation, written specifically to provoke systematic analysis and discussion.

Selection considerations

There are several factors you should consider when selecting the appropriate training method. These factors can be categorized into three major areas: constraints, cost-efficiency, and training considerations.

Constraints

Geographical spread of target audience – If the target audience is widely spread it may not be feasible to bring students to a central location for training. If this is the case, classroom training may not be the appropriate training method. You would want to consider other training methods such as OJT or self-study.

Availability of students – If there will be an insufficient flow of students due to lack of travel funds, number of students to be trained, or other reasons, it is not likely that formal classroom training is appropriate. Again, a better method may be OJT or self-study. Also, you may want to consider using CBT if there are large numbers of students to be trained over a long period.

Availability of instructors/trainers – If instructors/trainers are not available, you would want to consider other training methods such as self-study or CBT.

Availability of facilities and equipment – If there is a lack of adequate facilities and equipment to handle the student flow, you would want to consider OJT, self-study, ICW, and others.

Selection considerations (Continued)

Development time – Training methods such as CBT require considerable development time. If development time is limited or only a few students are to be trained, consider other training methods such as self-study, OJT, and others.

Cost-Efficiency

Trained Personnel Requirements (TPR) – Expensive delivery systems such as CBT may be justified if the TPR is large and the training is required over a long period.

Content stability – If the training content requires frequent updates or revisions, CBT is less suitable than classroom, OJT, or self-study.

Amount of practice required – If a lot of practice is required, you would want to consider CBT as a training method since practice time is limited only by the availability of the student and the equipment. In the classroom or OJT, an instructor or trainer is required, which is costly.

Training Considerations

Task criticality – If task performance is critical, you would likely consider formal classroom training or OJT. Self-study would be a questionable training method for a critical task.

Learning difficulty – A task that is difficult to learn should be trained using the classroom, CBT, ICW or OJT method.

Training fidelity – If the training fidelity requirement is high, you should select a training method that uses the actual equipment to train the process or procedures.

Interaction level – If the learning process requires a great deal of interaction, OJT is probably the best since it is highly interactive. If the group size is small, classroom training can provide moderate interaction. You would not want to use self-study if the learning process requires high interactivity.

Select Media

Introduction

Although selection of training methods and media is discussed individually, they can't always be considered separately. No single medium is the most appropriate choice for every training situation. Proper media ensures that information is presented to the students by the most effective and cost-efficient means possible.

What are media?

Media are the means, instrument, or material used to communicate information – in other words, the means used to give information to the students. Examples of media include classroom instructor, study guides, CBT, ICW, satellite training, interactive video, and numerous other types.

Who is responsible?

Selecting media for the training system is the overall responsibility of the instructional developer. If a design team approach is used, the appropriate team members will assist the developer in selecting the most effective, cost-efficient media for the system.

Types of media

There are several types of training media, as shown below.

Types of Media	Examples
Instructor/tutor	Lecturer Demonstrator Tutor/Coach
Traditional audiovisual devices	Chalkboards Transparencies Overhead projectors Slides Pre-narrated slides Microfiche Film strips (silent/pre-narrated) Video tapes Slide/workbook/tape recorder combinations

Types of media (Continued)

Types of Media	Examples
ICW	CBT (traditional) IVD
Print	Workbooks Study guides Job aids Training manuals Programmed instruction booklets Technical orders
Training devices and simulators	Actual equipment trainers Flight simulators Part-task trainer Computer simulation

Media characteristics

Media have various characteristics that make them either suitable or unsuitable for particular training situations. Consider these characteristics carefully to ensure that the appropriate media are selected for the training system. The advantages and limitations of each type of media are listed below.

Material	Advantages	Limitations
Printed Materials	1. Include common types of materials. 2. Wide variety of applications. 3. Simple types quick to prepare.	1. Sophisticated types more costly to prepare. 2. Require suitable reading ability.

Media characteristics (Continued)

Material	Advantages	Limitations
Overhead Transparencies	1. Can present information in systematic, developmental sequences. 2. Use simple-to-operate projector with presentation rate controlled by instructor. 3. Require only limited planning. 4. Can be prepared by variety of simple, inexpensive methods. 5. Particularly useful with large groups.	1. Require special equipment and skills for more advanced preparation. 2. Are large compared with other projectors.
Audiotape Recordings	1. Easy to prepare with regular tape recorders. 2. Can provide applications in most subject areas. 3. Equipment for use is compact, portable, and easy to operate. 4. Flexible and adaptable as either individual elements of instruction or in correlation with programmed materials. 5. Duplication easy and economical.	1. Have a tendency for overuse, as lecture or oral textbook reading. 2. Fixed rate of information flow. 3. Low fidelity of small portable recorders. 4. Utilize only one sense.

Media characteristics (Continued)

Material	Advantages	Limitations
35-mm Slide Series	1. Requires only filming, with processing and mounting by film laboratory. 2. Results in colorful, realistic reproductions of original subjects. 3. Prepared with any 35-mm camera for most uses. 4. Easily revised and updated. 5. Easily handled, stored, and rearranged for various uses. 6. Increased usefulness with tray storage and remote control by presenter. 7. Can be combined with tape narration for greater effectiveness. 8. May be adapted to group or individual use.	1. Requires some skill in photography. 2. Requires special equipment for close-up photography and copying. 3. Can get out of sequence and be projected incorrectly if slides are handled individually.

Media characteristics (Continued)

Material	Advantages	Limitations
Multimedia Presentations	1. Can demand attention and create strong emotional impact on viewers. 2. Can compress large amounts of information into short presentation time. 3. Provide for more effective communications in certain situations than when only a single medium is used.	1. Require additional equipment, complex setup, and careful coordination during planning, preparation, and use. 2. Equipment and production costs high for complex programs.
Video and Film	1. Particularly useful in describing motion, showing relationships, and giving impact to topic. 2. Allow instant replay of video recording. 3. Videotape reusable. 4. Easy to record lip sync on videotape. 5. May include special filming techniques (animation, time-lapse). 6. Combine still and motion on videodisc. 7. Standardized film projector available everywhere.	1. High cost for studio production equipment. 2. Resolution limited with video for fine detail. 3. Incompatibility of some video format types. 4. Value of investment in motion picture equipment reduced as video replaces film. Note – Videotape fast replacing 16mm-film medium.

Media characteristics (Continued)

Material	Advantages	Limitations
Interactive Courseware (ICW)	1. Presents text information and graphic images. 2. Interacts with learners on individual basis through asking questions and judging responses. 3. Maintains record of responses. 4. Adapts instruction to needs of learner. 5. Controls other media hardware. 6. Can interface computer and video for learner-controlled programs.	1. Requires computers and programming knowledge. 2. Requires essential hardware and software for development and use. 3. Incompatibility of hardware and software among various systems.

Media selection by learning outcomes

Selections of training methods were discussed previously in this section. Selection of the "right" method(s) is important and has an impact on selecting the best media based on the desired learning outcomes of the objective(s).

The following table lists the implications for media selection indicated by the type of learning outcome intended by the instructional objective.

Learning Outcomes	Exclusions	Selections
Intellectual Skills	Exclude media having no interactive feature. Exclude printed discourse for nonreaders.	Select media providing feedback to learner responses. Select audio and visual features for nonreaders.
Cognitive Strategies	Exclusions same as for intellectual skills.	Select media with same features as those for intellectual skills.
Verbal Information	Exclude only real equipment or simulator with no verbal accompaniments. Exclude complex prose for nonreaders.	Select media able to present verbal messages and elaborations. Select audio and pictorial features for nonreaders.
Attitudes	Exclusions same as for verbal information.	Select media able to present realistic pictures of human model and the model's message.
Motor Skills	Exclude media having no provision for learner response and feedback.	Select media making possible direct practice of skill, with informative feedback.

Media selection for integrated activities

Most types of complex skills involve multiple objectives from different domains of learning. A skill that involves two or more objectives from different learning domains involves integrated learning activities. Media selection for integrated learning activities must take into consideration the enterprise and the learner's schema, metaskills, and experience.

Enterprise. An enterprise is an integrated, purposeful activity that usually leads to accomplishment of a goal. For example, an individual might have an enterprise to build and fly an airplane. An individual does not have to have all the prerequisite skills to engage in an enterprise. The importance of an enterprise is that it is purposeful and relevant to the learner. This motivates the learning behavior necessary to complete the component tasks.

Schemas. A schema is an individual's organization of knowledge. Schemas may take the form of scripts (a kind of story or scenario that organizes information) or frames (a structure that looks like a table or matrix into which information fits). Different levels of learners have different types of schemas. A novice learner (in a particular subject area) has a very sketchy schema or structure into which new information can be placed. An experienced learner (one who has had some training in a subject area) has a better structure and therefore is a quicker learner than the novice. Finally, an expert has a very highly developed schema and is probably capable of rapid learning with very little learning support.

Metaskills. Metaskills are cognitive strategies that an individual applies to the processing of new information in a novel situation (a scenario not previously experienced). These skills include chunking or organizing new information, recalling relevant schemas, adding the new information to the old schemas, and creating new schemas. Although metaskills are probably subject-independent, different individuals have different metaskill capabilities depending upon their experience with a particular subject content. For example, an expert has developed metaskills and can relate better to a novel situation than a novice. An expert is more efficient at processing new information and applying it to the novel situation.

Media selection for integrated activities (Continued)

Learner Experience. It is helpful to know how experienced a learner is when selecting media or teaching strategies. The more experience, the higher the level of metaskills and strategies the learner will be able to employ. Experienced learners can deal with larger steps of instruction and more complex learning environments. Novices, on the other hand, require simplification of complex contexts so they don't experience information overload while learning.

Guidelines for selecting media

Several guidelines for media selection are:

Select media that do not conflict with the specific training environment.
Select media that effectively meet the training objectives.
Select media that support the training strategy.
Select media that allow individualization of training to the greatest extent possible.
Select media with time, know-how, and dollar resources in mind.
Select media that are effective and cost-efficient.

Section E
Finalize Training Plan

Introduction

In the analysis phase of ISD, the manager started developing the training plan for the training system at that point. However, much of the information and documentation to be included in the training plan was not available. As training development progresses through the design phase, more information and documents are available for finalization of the plan.

Purpose

The purpose of finalizing the training plan is to:

Compile resource and course control documents into a single document that describes the training system being developed.
Document approval to implement the training.

When do you finalize the training plan?

Ideally, finalization of the training plan should occur at the end of the design phase after the training has been designed and all of the resource requirements have been accurately identified. If information or a document is not available at this point, the manager needs to gather it soon after entering the development phase in order to complete the training plan and get it approved.

Tasks to finalize the training plan

To finalize the training plan, perform the following tasks:

Compile all of the necessary resource and course control documents into a simple plan.
Write a narrative that describes the content of the training and the parameters of the course.
Provide a synopsis of the resource requirements to support, operate, and maintain the training system.

Who is responsible?

The manager is responsible for developing as well as finalizing the training plan. Training and support organizations will provide the manager with all the necessary information and documents.

Section F
Design Training Information Management System

Introduction

Managing training information is a difficult task. It involves updating records, scheduling students, tracking equipment and meeting budgets. Well-managed training information is necessary for an effective and cost-efficient training system.

Purpose

An automated training information management system enables those responsible for supervising various aspects of a training system to manage the training system in real time. It can also provide the instructors with the latest training/data materials available. For example, the automated system can be used by:

Instructors to update student status.
Registrar to track student status.
Curriculum developers to update training materials.
Training manager to manage resources.

Who is responsible?

The responsibility for designing a training information management system normally falls on a project manager or officer. However, the training or single-point manager has a responsibility for ensuring that the training information is managed effectively and cost-efficiently for the training system. In most cases, the manager will not have an option as to whether an automated information management system is designed for use or not. The decision is based on the availability of a management system. If a system does exist, it will likely be used by all involved in the training organization.

Design considerations

There are many things to consider when designing or redesigning a management system. Some of those are:

What is the system cost?
What are the hardware capabilities?
Are there any special environmental requirements for the hardware?

Design considerations (Continued)

What are the software capabilities?
Is the system documentation adequate?
Are the hardware and software user-friendly?
Does this system have proven reliability?
Is the system maintainable?
Will the system interconnect/interface to existing systems?
Is the system software compatible with other software?
Does the hardware have expansion capability?
Can the software be upgraded or modified easily?
What training information will the system be able to manage?

Other considerations include:

Who are the system users?
What information will they need to manage their jobs?
Has time been set aside to train the system users?
What information is common/unique?
How long must the information be maintained?
What reports will be required? Standard? One-time?
What outside information will be needed? Frequency of need?
What information will be required for each training system function? What interfaces will be required?

Section G
Update ISD Evaluation Plan

Introduction

An ISD evaluation plan was developed during the initial stages of ISD project planning. This plan was updated in the analysis phase of ISD to ensure that it remained an effective tool for evaluating the quality of the ISD process and products. Likewise, at the end of the design phase, the evaluation plan should be updated again as necessary.

Assessing quality

ISD is a quality management process. There are different ways to assess the quality of the design phase. One of the simplest ways is to develop a job aid using questions focused on quality improvements. Examples of questions are:

Does the ISD evaluation plan assess the quality of both process and products in the design phase?

Can the instructional design process be improved? If so, how?

Are the metrics or standards for the design process and products realistic and adequate? If not, why not?

Can the products of the design phase, such as objectives and tests, be improved? If so, how?

Are the products of the design phase accurate?

Do the products of the design phase contain adequate information? If not, what information should be added?

Do the products of the design phase contain information that is not needed?

Are products being developed during the design phase that are not needed?

Why update the plan?

Most ISD projects will be different due to the nature and scope of the project itself. For example, one ISD project may be to revise the training in an existing course while another project may be to develop training for a new course. Since most ISD projects have differences, it may be difficult to develop a totally accurate plan that doesn't require some updating. Therefore, as the design phase is completed, it may be necessary to update the evaluation plan. Updating the plan ensures that the most current and accurate information is used when evaluating the process and products of the development phase.

Who is responsible?

Updating the evaluation plan after the design phase is the responsibility of the instructional developer in cooperation with the training manager. However, everyone in the training organization is responsible for quality.

What should be updated?

To remain an effective evaluation tool, the plan should be updated after the design phase to reflect the most current and accurate evaluation data. Updating the ISD evaluation plan may include:

- Revisions to the plan such as:
  - Procedures to be used in evaluating the design process and products.
  - Design products to be evaluated, such as objectives and test items.
  - Standards to be used to evaluate the design process and products.
- Revisions to the evaluation schedule, such as:
  - When the design process and products will be evaluated.
  - Quality of products to be evaluated.
- Results of the design phase.
- Rationale for changes made to the ISD evaluation plan.
- Lessons learned during evaluation of the design process and products.

Tracing the quality process

Quality of the design process and the resulting products is essential to the training development process. Therefore, you should document evaluation of the design phase to the point that the quality process can be traced throughout the entire ISD process, including the design phase. However, document only what is needed; never document more than you need.

Section H
Update Management Strategies

Introduction

Management strategies provide a roadmap for managing training systems during the analysis phase and guide training development during the design phase. During the design phase, you need to update the management strategies to reflect current information and the latest status of the project. The update may include new or revised milestones, changes in resource constraints, or revisions to resource requirements.

Importance of management strategies

Management strategies ensure that the training project is on track, on schedule and under budget. Remember, training strategies:

Serve as a tool for managing the training system and the training development process.
Establish milestones for system and training development.
Ensure that an effective and cost-efficient training system is developed.

Why update management strategies?

Updating management strategies ensures that they reflect the current status of the project and remain an effective management tool. For example, during the design phase, you learn that you will not get all of the classroom and laboratory space you need and will have to use a smaller facility. An update in the management strategies is required to reflect information such as changes in the number of groups you can have in session, group size, and equipment requirements.

As you can see, if the management strategies are not continually updated, they can quickly become outdated, not reflecting the current status of the project.

Management strategies should be updated upon completion of your training design. The updated strategies enable you to enter the development phase with the latest "roadmap" of where you are going and how you are going to get there.

Who is responsible?

The manager is responsible for seeing that the management strategies are updated to reflect the current status of the project.

What should you update?

When updating management strategies, include the latest information from the design phase such as:

Changes to the overall management strategy for the training system and process.
Refinements to project definition.
Revisions to the resource requirements.
Changes in resource constraints.
New or revised milestones.
Addition or deletion of taskings.

Chapter 6
DEVELOPMENT

Overview

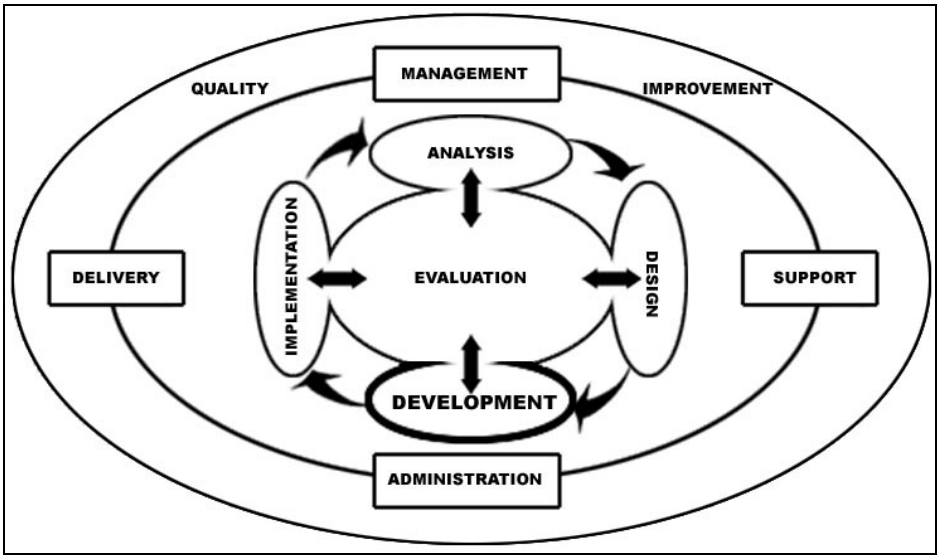
Introduction

After you have specified the objectives, developed tests, planned strategies and activities, you are ready to implement your design in the development phase. Some of the tasks in this phase include writing lesson materials, producing training media, developing ICW, etc. As an instructional developer, this is where all your efforts from earlier phases of ISD start to come together.

Where are you in the process?

To this point you have completed the analysis and design activities and you are now ready to enter the development phase. Figure 13 depicts the ISD model with the development phase highlighted.

Figure 11 Development Phase



Objectives

The objectives of this chapter are to:

Explain the tasks involved in developing training.
Discuss installation of training information management systems.
Define planning requirements of the development phase.
Explain the training validation process.
Discuss finalization of training materials.

Where to read about it

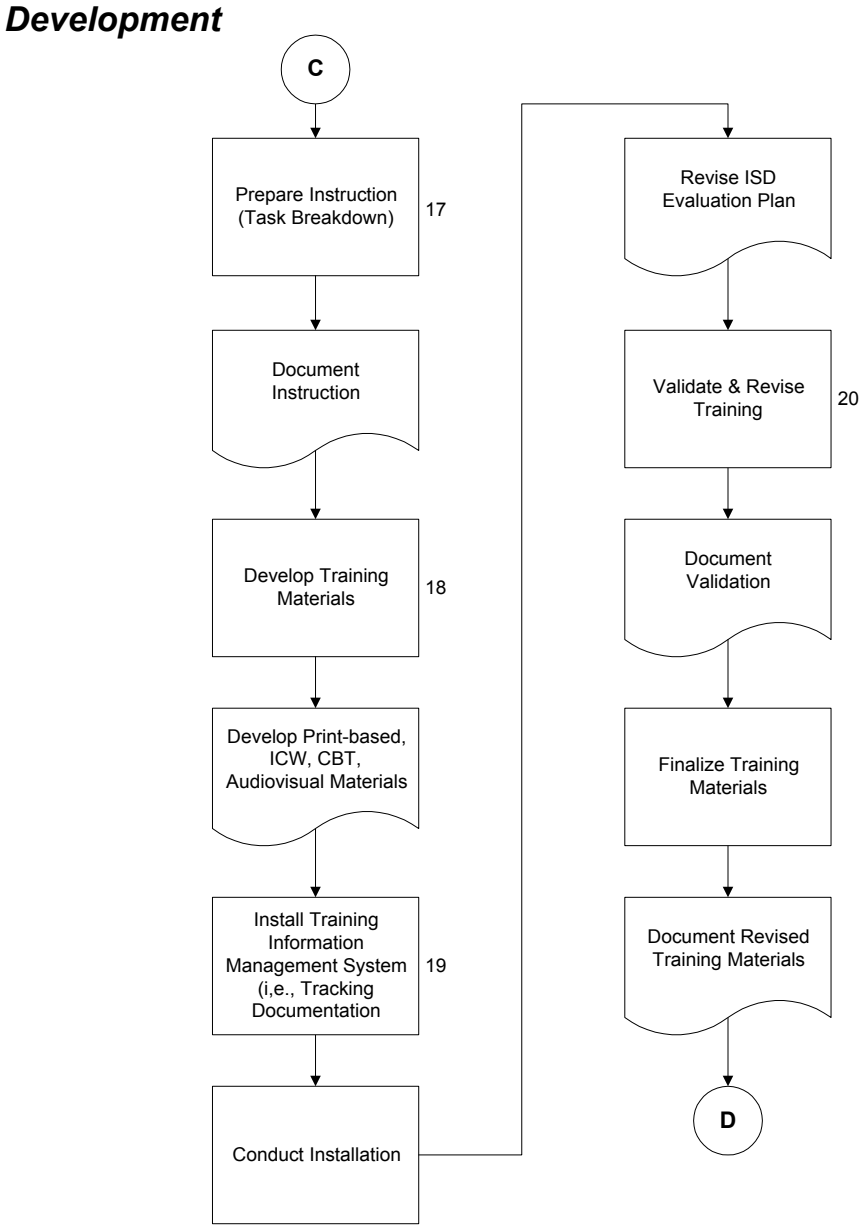
This chapter contains six sections.

Development process flowchart

The development portion of the training development flowchart (Figure 7) is provided below as a quick reminder of the activities involved in the design process. As a reminder, the numbers on the flowchart represent the development activities where the Technical Training Management System (TTMS) can help support the ISD process.

Development process flowchart (Continued)

Figure 7 Training Development Flowchart (D)



Section A
Prepare Plan of Instruction

Introduction

A Plan of Instruction (POI) serves as the overall plan or blueprint for conducting training in a given course. In some training organizations a course syllabus is used for the same purpose. POIs standardize training and control its quality.

Purpose

The POI is a control document used for planning, organizing, and conducting training.

POI contents

POIs expand the basic course control documents and provide necessary details for an instructor to develop specific lesson plans. Although the POI can be in different formats, it is normally organized by units or modules of training with each unit containing information such as:

Name of instructor
Course title
Unit or block title
Course content
Time allocations for each block or unit
Objectives
Student training materials
Audiovisual equipment
Training equipment
Training method(s) and time
Instructional guidance
Lesson plan approval date and signature
Lesson plan/teaching guide

Who is responsible?

Instructional developers and instructors prepare the POI or syllabus. However, the manager has the overall responsibility for its preparation, currency, and accuracy.

Guidelines for POIs

The basic guidelines for preparing a POI or syllabus are that it should:

Be usable.
Document the plan of instruction.
Be easily maintained.
Meet the organization's needs.

The format of the lesson plan is determined by the organization providing the training.

Example

Examples of a POI and a course syllabus are included on the following pages.

Example: Plan of Instruction/Lesson Plan

PLAN OF INSTRUCTION/LESSON PLAN PART I	
Name of Instructor Tsgt John Smith	Course Title Instructional Systems Developer
Block Title Plan, Develop and Validate Instruction	
1. Course Content	2. Time
5. Develop Media a. Given the necessary materials, prepare one transparency suitable for projection using the color lift process. STS REF: 7b MEAS: PC/W (1) Definition of Color-Lift (2) Materials Needed (3) Apply the procedures for preparing a transparency using the Color-Lift process SUPPORT MATERIALS AND GUIDANCE STUDENT INSTRUCTIONAL MATERIALS: WB 3AIR75100-6-I-5, Color Process Magazines AUDIO-VISUAL AIDS: Transparencies, Color-Lift process TRAINING EQUIPMENT: Overhead projector, scissors, shallow pan, water, paper towels, document protector, sheet of plastic acetate TRAINING METHOD(S) AND TIME: Demonstration/Performance (1 hr) PLAN OF PRESENTATION/INSTRUCTIONAL GUIDANCE: Using the Color-Lift process, explain and demonstrate the technique for making a transparency. Ensure that enough materials are available for each student. Have students make one transparency suitable for projection and evaluate it for neatness and errors.	1 Hr
Supervisor Approval of Lesson Plan	
Signature and Date	Signature and Date
MSgt Bob Jones 1 July 1992	

PART II – TEACHING GUIDE

INTRODUCTION (2 MIN)

ATTENTION:

Imagine if you will, a time three to four weeks from now. You have just finished teaching your first class of students. They did well and all graduated. You have received a number of compliments on the way you presented the material and it made you feel good. Tomorrow you can relax - it's Saturday. Then the phone rings. It's the Boss! He just realized that a group from the Rotary club is scheduled to visit the Department tomorrow at 10:30 and since your class has graduated, he wants you to prepare a briefing for them, to include visual aids. You hurriedly visit the visual services branch, and they have nothing that could fill the bill and besides their workload is such that they couldn't possibly produce a thing for you before next Thursday. What do you do?

OVERVIEW:

5a. Given the necessary materials, prepare one transparency, suitable for projection, using the Color-Lift Process. Show TP #1.

(1) Definition of the Color-Lift Process

(2) Materials needed

(3) Apply the procedures for preparing a transparency using the Color-Lift process.

MOTIVATION:

There may be times that you are required to present a briefing or lesson and there are no training aids available. Today you'll learn a process that will enable you to develop colorful and professional-looking transparencies with very little cost or time involved.

TRANSITION:

We will begin our lesson by first defining the Color-Lift Process so that each of us has the same understanding of this term.

BODY (30 MIN)	
PRESENTATION 5a. Given the necessary materials, prepare one transparency, suitable for projection, using the Color-Lift Process. (1) Definition of the Color-Lift Process – a process whereby claycoated pictures are transferred to an acetate sheet for use as a transparency (2) Materials needed (a) Magazine picture (b) Sheet of plastic acetate (c) Document protector APPLICATION 5a. Given the necessary materials, prepare one transparency suitable for projection using the Color-Lift Process. (1) Administer Performance Test 3AIR75100-5a EVALUATION 1. Students will be observed and questioned during the lesson presentation and in the application step. 2. Student transparencies will be evaluated using performance checklist 3AIR75100-5a.	EXPLANATION (15 MIN) Show TP #2 TRANSITION: We have defined the Color-Lift Process; now let's see what materials are needed. Although a number of materials are required, they are easily obtained and simple to use. Note: Must be clay-based, covered in TS-3. EXAMPLE. Plastic used to seal your Social Security Card. Note: Will be used for the transparency. PERFORMANCE DISTRIBUTE: Materials and performance test. Explain student responsibilities and procedures for completing test. EVALUATION 1. During student performance, supervise and assist as necessary. 2. Sign off AETC Form 667

CONCLUSION (3 MIN)

SUMMARY: 5a. Given the necessary materials, prepare one transparency, suitable for projection, using the Color-Lift Process.

Show TP #3 (1) Definition of the Color-Lift Process – a process whereby clay-coated pictures are transferred to an acetate sheet for use as a transparency

Show TP #4 (2) Materials needed

(a) Magazine picture

(b) Sheet of plastic acetate

(c) Document protector

Show TP #5 (3) Apply the procedures for making a transparency using the Color-Lift Process

(a) "Clay-test" the picture

(b) Peel acetate from the paper-backing sheet.

REMOTIVATION:

We never know when we will be called upon to give a presentation. The Color-Lift Process, because it is fast and professional looking, will aid us greatly in being able to give a no-notice or last-minute lecture or briefing containing transparencies of the highest quality.

CLOSURE:

Don't forget how to use the Color-Lift Process. It's easy and it will distinguish your future presentations in a very positive way.

Example: Course Syllabus

DEPARTMENT OF THE AIR FORCE ACC SYLLABUS
Headquarters, Air Combat Command Course No. AB00000
Langley Air Force Base, Virginia 23665-5001

USAF OPERATIONAL TRAINING COURSE

E-3 MISSION CREW COMMANDER

2 JULY 1992

INTRODUCTION

This syllabus prescribes the overall training strategy and average amount of instruction required for a student having the entry and prerequisites to attain the course goals. Units tasked to implement this syllabus are responsible for ensuring that each student demonstrates the knowledge and skill proficiencies set forth in the course training standards. Within syllabus and other directive constraints, the amount and level of training devoted to mission elements, events, subjects or phases should be adjusted, as required, to meet the needs of individual students.

Instructions governing publication and revision of ACC syllabi are contained in ACCR 8-1.

OFFICIAL

JOHN DOE, General, USAF
Commander

MARY SMITH, Colonel, USAF
Director of Information Management

CHAPTER 1

COURSE ACCOUNTING

SECTION A – COURSE DESCRIPTION

1-1. COURSE TITLE/NUMBER. E-3 Mission Crew Commander (MCC) Basic Qualification Course, E3000BQOBX.

1-2. PREREQUISITES. These requirements will be completed prior to the formal course start date for the track being entered. The MCC course is divided into three tracks:

a. Track 1, Air Surveillance Officer (AS) upgrade to MCC.

(1) Must be a Mission Ready ASO, AFSC 1744D

(2) Must be a Major or Major selectee

(3) Must have 300 flight hours as an ASO in the E-3 aircraft

b. Track 2, Senior Director (SD) upgrade to MCC.

(1) Must be a Mission Ready SD, AFSC 1711/1716.

(2) Must be a Major or Major selectee

(3) Must have 300 flight hours as a WD and SD combined

c. Track 3, personnel with no prior experience in AFSC 17XX or 17XX personnel with no E-3 experience.

(1) Current Flight Physical Class III. Physical must be current for a minimum of six months after reporting to Tinker AFB.

(2) Current Physiological training, including rapid decompression, before departure from present duty location. Training must remain current for one year from reporting date at Tinker AFB.

(3) Must complete Basic Survival Training Course S-V80, and either Water Survival Course S-V86-A or S-V90-A before departing from present duty location.

(4) Complete Life Support Training at Tinker AFB.

(5) Must have a Top Secret and SCI security clearance.

(6) Graduate of accredited Weapons Control school and have AFSC 1711/1716 with one-year experience in Automated Radar Systems (Sage, Buic, 407L, 412L).

(7) Those personnel not satisfying the requirements of item (6) will complete the academic and simulator portion of the ASO/WD Basic Qualification Course (E3000BQOGX/E3000BQOBX).

Continued

(8) Must be Major or Major selectee.

1-3. PURPOSE/STATUS UPON GRADUATION. To train personnel meeting course prerequisites to basic qualification (BQ) status in the Mission Crew Commander crew position in the E-3. Graduates receive an E-3 rating of BQ IAW ACCM 51-60.

1-4. LOCATION. 522 AWAC Division, Tinker AFB, Oklahoma.

1-5. DURATION.

a. Track 1 will be 43 training days divided into 13 ground training days and 30 flying training days.

b. Track 2 will be 45 training days divided into 15 ground training days and 30 flying training days.

c. Track 3 will be 64 training days divided into 20 ground training days and 44 flying training days.

1-6. AMOUNT.

	TRACK 1	TRACK 2	TRACK 3
a. Academic Training Hours:	86	92	117
b. Aircrew Training Device Hours:	11	11	27
c. Flying Sorties/Hours:	8/64	8/64	13/114

SECTION B – FLYING INVENTORY

1-7. The following charts show the average number of effective sorties required by each student.

TRACKS 1 and 2

(ILLUSTRATION)

TRACK 3

(ILLUSTRATION)

SECTION C – AIRCREW TRAINING DEVICE INVENTORY

1-8. MISSION SIMULATOR.

	TRACK 1	TRACK 2	TRACK 3

Section B
Develop Training Materials

Introduction

In the design phase, you select the training method and media that best suit your training needs. At this point, you start developing the media selected to implement your training design. Developing training materials is a time-consuming and exacting task. Regardless of the media selected, it is essential that you develop a quality product since it is the vehicle that carries the information to the students.

Description

As a reminder, media are the means, instrument, or material used to communicate information; in other words, the means used to give information to the students. Examples of media range from the classroom instructor using a lesson plan to study guides, CBT, satellite training, interactive video, or numerous other types of media.

Training material delivery

Training materials can be delivered via:

Instructor
Print-based material
Slide/tape
Audio/video tapes
CBT
Interactive video
Training devices/aids
Satellite

Factors in media development

Several factors affect the development of training media and materials. The relative importance of each of these factors depends on the media you have selected. These factors are:

Development personnel required
Development time required
Development cost required

Development activities

Development of training materials requires many activities to be performed. The type and number of these activities depend upon the type of training materials being developed. Some of the most common development activities are listed below.

Medium	Development Activity
Print	Draft/write material Edit material Publish material
Transparencies	Draft transparency Generate reproducible transparency Reproduce transparency
Slide/Tape	Storyboard/script slide or tape Shoot and edit slide/tape Narrate audio Print slide/tape
Videotape	Storyboard/script Shoot and edit video Develop audio
CBT	Storyboard/script Develop graphics Program/code computer
Interactive Video	Storyboard/script Shoot and edit video Develop graphics Develop audio Program/code computer

Who is responsible?

Developing training materials normally involves teamwork and requires various skills. Curriculum developers are responsible for planning, scheduling, and making sure the training materials get produced. Team members required for production of different media are listed on the following page.

Who is responsible? (Continued)

Medium	Development Role
Print	Subject Matter Experts Curriculum Developer Editor Graphic Artist
Transparencies	Subject Matter Experts Curriculum Developer Graphic Artist Editor
Slide/Tape	Script Writer Subject Matter Experts Photographer Sound Technician Editor
Videotape	Script Writer Subject Matter Experts Video Producer, Editor, Cameraman Sound Technician
CBT	Script Writer Subject Matter Experts Graphic Artist Computer Programmer
Interactive Video	Script Writer Subject Matter Experts Video Producer, Editor, Cameraman Graphic Artist Sound Technician Computer Programmer

Effective instructional design

To ensure that materials are instructionally sound, make sure they:

Support the objectives.
Are student-centered.
Build learning on learning.
Meet the design that was specified in the design phase.
Lead students in the direction of the behavior specified in the objective and guide them toward mastery of the task with proper stimuli and reinforcement.
Use appropriate vocabulary at the level of the target population.
Are properly paced.
Are easy to understand.

Guidelines for product development

When developing instructional materials, build in:

Techniques that are consistent with the principles of effective learning.
Interest, meaning, and appeal to maintain student attention.
Student participation, as with ICW.
Expertise of programmers, photographers, graphic artists, scriptwriters, and editors.
Quality assurance checks prior to publication/production to ensure technical and programming accuracy, completeness, and clear visuals.
Appropriate safety precautions.
Support for the human relations concepts to which the Air Force is committed.

Additional information

For additional information on training development, see:

AFMAN 36-2234, Instructional System Development, Development chapter.
AFMAN 36-2236, Handbook for Air Force Instructors.
Leshin, C. B., Pollock, J. and Reigeluth, C. M. (1992). *Instructional Design Strategies and Tactics*. Englewood Cliffs, New Jersey: Educational Technology Publications.

Section C
Install Training Information Management System

Introduction

As stated in the previous chapter, you will probably not be involved in designing or redesigning a training information management system. However, you may be involved in its installation. This section discusses the basic issues of installing a training information management system.

Who is responsible?

A project manager or officer will normally have the overall responsibility for installing a new training information management system, revisiting an existing system, or modifying the software of an existing system. However, individuals from various training organizations will likely be involved in testing of the system. For example, an instructor may be asked to update student records and an instructional developer may be asked to update training materials in the system.

What should be checked?

During the installation and testing of a training information management system, there will likely be documents that guide installation and checklists to test system operation. These documents or checklists are normally sufficient; however, if they are not, there are numerous items that should be checked. Examples of items that can be checked are:

Are the operating instructions adequate?
Is the hardware user-friendly?
Is the software user-friendly?
Are the hardware and software sufficiently documented to support maintenance?
Are there adequate terminals to do the required tasks in a timely manner?
Is the information management in each area accurate?
Is the information management in each area complete?
Is the system reliable?
Is the system adequately interfaced with other users in the organization?

Section D
Update ISD Evaluation Plan

Introduction

An evaluation plan is a "metric" or standard for evaluation of the ISD process and products. It is developed initially in the planning stage and updated through the analysis and design phases. To ensure that the evaluation plan is effective throughout the life cycle of the project, you need to update it again in the development phase.

Assessing quality

ISD is a quality management process used to ensure the quality of the development process as well as the products of that process. The ISD evaluation strategy should include procedures for evaluating the development phase and its products to assess the overall quality. A good method for assessing quality is to develop a job aid. There are other ways but they may not be as easy to develop and use. One of the simplest ways to develop a job aid is to use a series of questions such as the following.

Does the ISD evaluation strategy for the development phase assess both process and product quality?
Are the quality standards for the development phase realistic and adequate?
Can the development process be improved? If so, how?
Can the products of the development phase be improved or simplified? If so, how?
Are the various products of the development phase accurate and do they agree with other products of this phase? For example, do the objective, training standard, POI, lesson plan, and student materials all agree?
Are there any products in the development phase that are not needed?
Are there additional products that should be developed?

Why update the evaluation plan?

Each time you start an ISD project you will need to develop an ISD evaluation plan or strategy. The strategy you use to evaluate the various ISD projects will likely be different since most ISD projects are different. For example, in some ISD projects you may develop training to be delivered by an instructor. In other cases, you may develop computer-based training to be exported to the field. For this reason, it will be difficult to develop an evaluation strategy during the initial planning stages that doesn't require updating. If you are to effectively evaluate the entire ISD process, you must periodically update the evaluation strategy to keep it current, reflecting the actual status of the evaluation process. Updating the strategy will not only keep the development effort on course but will also ensure quality.

Who is responsible?

Managers are responsible for developing and updating the ISD evaluation plan with assistance from the instructional developers or design team.

What should be updated?

The ISD evaluation plan should be upgraded periodically so that it remains an effective management and evaluation tool. Update the ISD evaluation plan to include new or revised information such as:

- Changes in the evaluation strategy for the development phase. For example:
  - Types of products to be evaluated such as training materials, lesson plans, and ICW
  - Procedures to be used in evaluating the development process and products
  - Standards or metrics to be used in the evaluation
- Revisions to the evaluation schedules such as:
  - Quantity of products to be evaluated
  - When the development process and products will be evaluated
- Documentation of results of the development phase
- Rationale for changes made to the ISD evaluation strategy during the development phase
- Lessons learned during the evaluation of the development phase

Tracing the quality process	QI is an important part of the ISD process. The quality process is documented to the point that it is traceable throughout the life cycle of the project. Document only what is necessary, and no more.

Section E
Validate and Revise Training

Introduction

At this point in the instructional development process, objectives have been developed, tests written, instructional methods and media selected, and instruction is being developed. Yet, there is no assurance the instruction will be effective. Therefore, the instruction should undergo **validation** to prove that the instruction provides graduates with skills, knowledge, and attitudes to meet job performance requirements. If deficiencies are found in the instruction during validation, they are corrected before course implementation. Validation consists of technical accuracy review, individual tryouts, and small-group tryouts that are conducted as a part of formative evaluation and operational (field) tryouts that make up **summative evaluation**.

What is validation?

Validation assesses the effectiveness of instruction while it is being developed with the intention of improving it. It is a process of repetitive cycles of development, tryouts, and revisions until evidence shows that the instruction is effective.

When should validation be done?

When possible, validation is done as segments, units, or blocks of instruction are developed or revised. It is best for instructional developers and instructors to wait until all of the instruction has been developed before determining its effectiveness.

Where to read about it

This section covers five topics.

Develop Validation Plan

Introduction

For a training system to be effective, adequate planning should take place in the initial stages of training development. A part of that planning is the evaluation plan which often includes a plan of how the instruction is to be validated. These plans can be separate or can be subsets of other plans. Validation planning is essential for successful implementation of an instructional system.

Purpose

A validation plan provides instructional developers and instructors with a roadmap for validating the instruction. A validation plan provides organization and creditability to the validation process.

Who is responsible?

Validation planning is the responsibility of managers within the organization or the design team. This responsibility is often delegated to instructional developers since they often provide much of the information that goes into the validation plan such as the validation schedule, number of individual tryouts, and number of tryouts to be conducted.

What is in a validation plan?

Validation plans may contain information such as:

Description of instruction to be validated (objectives, method, and media).
Who may conduct the validation?
Validation procedures.
Validation schedules.
Program schedule constraints.
Number of tryouts to be conducted in each of the tryout activities.
Number and availability of students to be used in the tryouts.
Sources and how the results should be documented.
How problems should be resolved.

Getting ready to validate

Prior to starting validation, you should:

Understand each activity in the validation process.
Know who is expected to conduct the various activities.
Know when the activities are to occur.
Ensure that the training is ready.
Ensure that students have been scheduled.
Know how to document any deficiencies.
Know procedures for revising training, if applicable.

How to use a validation plan

Using the plan, those validating the instruction follow the predetermined guidelines and standards for evaluating the effectiveness of the instructional system under validation. Using the plan also provides organization to the process and adds credibility by providing a documented process. Following the validation plan's established guidelines and standards ensures that:

Each component of the instructional system is measured against a predetermined standard. If components of the system do not meet the criterion/standard, then an analysis of the component(s) should be conducted to determine why they do not meet the established standard. First, determine if the standard is realistic and valid. If so, then examine why the established standard is not being achieved.
For example, a majority of the students are unable to accomplish a specific performance task in the time specified. A check of the technical data and with subject matter experts (SMEs) indicates that the standard is correct. A further analysis of the lesson plan reveals that the task procedures are being taught incorrectly, thus causing additional time to be needed to complete the task.
Validating each component of the instructional system against standards established in the plan allows those components not meeting standards to be identified and corrected as necessary, thus ensuring the quality and effectiveness of the instructional system to be maintained.

How to use a validation plan (Continued)

Following the established guidelines in the validation plan ensures that the validation of the instructional system is performed in an organized, timely manner with each component of the instructional system being validated at the appropriate time in the process.

For example, the plan identifies each component of the instructional system, how each component will be validated, when each component will be validated, and the standard to be used in the validation process.

The plan also serves as the basis for reporting results of the validation process.

Remember, keep the validation plan as simple as possible – only include information that is necessary to validate the instructional system.

Conduct Technical Accuracy Reviews

Introduction

The **technical accuracy review**, which is a formative evaluation activity, is the first step of the actual validation process. This review identifies inaccuracies and weaknesses in the materials under review. Materials should be thoroughly reviewed, since this may be the last opportunity to revise draft materials before they are tried out on the students. If possible, and when applicable, conduct technical accuracy reviews each time instruction is developed, updated or revised.

Purpose

The purpose of the technical accuracy review is to verify the accuracy of the training materials as they are developed, if possible, in order to identify inaccuracies and weaknesses in the materials so they can be corrected.

Who should review?

Internal reviews should be conducted by:

SMEs
Instructional developers
Instructors

An individual selected to conduct a review should be:

Knowledgeable of instructional design and development.
Subject matter expert.
Concise and constructive critic.

What should be reviewed?

Instructional materials to be reviewed include, but are not limited to:

Objectives
Test items
Storyboards/scripts
Audiovisual materials such as slides, films, videotapes, transparencies
Job aids
Printed materials
CBT such as ICW, CMI

How to conduct a review

There are many ways to review training materials for accuracy, completeness, and quality. The bottom line is to cross-check the materials against the data sources such as technical orders, regulations, directives, and checklists. One method of helping conduct the review is to develop a job aid. An example is provided.

Sample Job Aid for Internal Review

1. Is the content of the material accurate?
2. Is the material current?
3. Is the material complete?
4. What are the "good" parts of the material?
5. Are there any "bad" parts in the material?
6. Does the sequence of the material build learning on learning?
7. Are the practice exercises adequate?
8. Are the review exercises adequate?
9. Does the material/lesson effectively teach the behavior specified in the objective?
10. Is the objective adequately evaluated?
11. Is the content of the material compatible?
12. Can the materials be improved? If so, how?

During a review

When conducting a review, the reviewers should:

Take careful notes while conducting the review.
Make specific comments.
Identify weaknesses in the materials.
Recommend ways to improve the materials.

After a review

After the review, the reviewers should:

Discuss their review findings.
Determine what revisions or changes should be made to the materials.
Decide the best way to make the necessary corrections to the materials.
Make revisions and changes to the materials, as applicable.

Conduct Individual Tryouts

Introduction

Individual tryouts, a formative evaluation activity, are normally the next step in the validation process. During this step, as the training and materials are being developed, they are tried out on individual students. The instruction and materials need to be tried out on several students, if practical, in order to add validity and reliability to the data collected during the tryout. It may not always be possible to conduct individual tryouts due to resource constraints.

Purpose

The purpose of individual (one-on-one) tryouts is to determine the effectiveness of small segments or units of instruction and materials as they are developed, updated or revised.

Select students

A great deal of care should be used when selecting students to participate in the individual tryouts. During the selection process, consider the following factors:

Students selected for the tryouts should be from the target audience and fall within the predetermined range of:

- Aptitude
- Skills
- Attitude
- Prior knowledge
- Background experience

If students do not fall within the range, tryout results can be skewed. Thus, student performance cannot be generalized to the target audience.

Students for the first tryouts should be selected from the upper percentage ranges in aptitude and background because:

- Brighter students are often more likely to point out and analyze weaknesses in the instruction and materials.
- If better students cannot learn the material, less capable students may not be able to.
- If lower-level students are used in the individual tryouts and they do well, there is no way to tell if the training and materials are at the proper level.

Select students (Continued)

It is easier to work down from a known point of difficulty than to work up from an unknown point of difficulty.
It is simpler to add material to make a lesson or material easier than to delete material to make it more difficult.

Media use during tryout

The nature of the tryout should depend, to some degree, on the media selected for use in the course. Certain types of media selected for use in the course may be too expensive for use during the individual tryouts or may not be available. However, there are ways to validate the instruction and materials without having all of the media selected for the course. Following are examples.

If Media Selected Is . . .	Conduct Individual Tryout by . . .
Paper-based media Available such as job aids, simulators, trainers Capable of being quickly and economically developed such as slides, graphics	Using the actual media that will be used in the course during individual tryouts.
Not available Dangerous to use Expensive to develop	Devising storyboard versions of the instruction. For example: Paper script can be used in place of ICW, films. Drawings and illustrations can be used in place of ICW, slides. Mockups can be used to replace the actual media.

Before a tryout

Before conducting the individual tryouts, instructional developers should prepare the students for the tryouts. Students need to know:

The purpose of the tryout.
Their role in the tryout.
That they are not being evaluated; the training and material are.
That their active participation is essential if the individual tryout is to be successful.
That their feedback is necessary in determining adequacy of the training and materials.

If instructors are involved with the individual tryouts, they should be aware of their role and the role of the student.

During a tryout

During the individual tryouts, instructional developers should:

Closely observe students as they use the material.
Make careful note of where students seem to have problems or uncertainties.
Give assistance to students only when it is essential to student progress.
Administer the relevant test item at the appropriate time.
Get the students' view about the difficulties encountered during the tryout.

Sources of individual tryout information are provided below.

Source	Activity/Information
Diagnostic Tests	Administer pretest to identify entry behavior. Administer posttest to assess learning as a result of the tryout.
Student Performance During Learning	Observe and record students' performance. Determine which exercises or tasks result in errors; types of errors; how many students are making the same error(s).

During a tryout (Continued)

Student Comments	Get student reaction to the instruction and materials, especially their difficulties. Ask students for suggestions on how the instruction and materials can be improved.

Typical problems

Often, when conducting individual tryouts, problems are identified that are typically found during the first tryouts. Some of the typical problems are:

Improper sequencing of the training.
Instruction not clear and concise.
Lack of supporting training materials.
Confusing test items.
Test items that do not measure objectives.
Insufficient practice time.

After a tryout

When the individual tryouts have been completed, analyze the resulting data to determine if error patterns or problems have occurred on successive tryouts. If so, changes or revisions to the training or materials may be appropriate.

Example: Each student participating in the individual tryouts fails to meet the performance standard for a particular objective. Review the objective, training materials, and test, and revise as necessary.

In most cases, several tryouts should be conducted before making any significant revisions or changes to the training or materials.

When significant revisions or changes are required in the training or materials, it is recommended that additional individual tryouts be conducted in order to determine if the problem was solved.

Conduct Small-Group Tryouts

Introduction

After the individual tryouts have been completed and all necessary revisions have been made to the training, it is time to conduct the next stage of validation, which is the **small-group tryouts**. In this stage, which is the last activity in formative evaluation, the training and materials are tried out on small groups of students, if practical. Again, a lack of resources may prevent or reduce the number of small-group tryouts that can be conducted. Up to this point, the success of the instruction has been based on a limited sampling of students with higher aptitudes. It should be pointed out that the training and materials are developed for average students; thus, small-group tryouts are focused on the average group.

Purpose

The purpose of conducting small-group tryouts is to determine if the training and materials work under conditions approximating the actual teaching-learning activity.

Select students

Student selection for the small-group tryout is again very important in terms of validating the effectiveness of the training and materials. Students selected to participate in the tryout should be representative of the target audience. If possible, students selected should have:

- Even distribution between low and high aptitudes.
- Varying skill levels.
- Different backgrounds.

Even distribution of students helps determine if the training and materials will be effective under operational conditions.

The number of students included in the small groups should be determined based on factors such as:

- Need for teams of students within the small group (for example, some tasks may require students to work in teams of two; if so, the small-group size should be based on multiples of two).
- Planned normal group size of the operational system.
- Availability of equipment.
- Availability of facilities.

Time is a critical factor

To this point in the validation process, time required to perform a task has not been of major concern. However, time becomes a critical factor in the small-group tryouts. Learning the material or performing a task is not sufficient; students should be able to learn the information or perform the task within a reasonable time period. Therefore, effort should be made to develop training that can be accomplished within a realistic time period based on training requirements and the capability of average students.

Before a small-group tryout

Before trying out training on small groups, you should:

Determine number of students to be included in the small group.
Determine the number of groups to be used in the tryouts.
Select representative students from the target audience.
Ensure that the training and materials have been revised to include the applicable information resulting from individual tryouts.
Ensure that student materials are available in adequate quantities.
Ensure that resources such as equipment, personnel, and facilities to be used during the tryout approximate the operational conditions.
Ensure that the instructional information management system is operating for data collecting, analysis, and reporting.

During a tryout

When conducting small-group tryouts, you should:

Ensure that the time required for each student to complete the material is accurately recorded. This information is used to determine unit times, course length, and course content.
Record accuracy of student responses. This information should help determine deficiencies in the training or materials.
Establish the number of trials a student should be permitted to meet performance requirements.

Don't supplement the instruction. Supplementing the instruction may skew the results of the tryout.

After a tryout

Conduct a sufficient number of small-group tryouts to ensure that the data collected is both valid and reliable. Once the data has been collected, they should be analyzed to determine:

Median time required to complete each segment or unit of training (this information is used to set the approximate times for lessons, segments, units, or modules of instruction)
Need to revise equipment requirements, make changes to facilities, and adjust personnel authorizations
Training and materials requiring revisions or changes
Priority for accomplishing revisions or changes and plan of accomplishment

As with the individual tryout, if the training or materials require significant revisions or changes, it is recommended that additional small-group tryouts be conducted to determine if the revisions were effective.

Conduct Operational (Field) Tryouts

Introduction

The **operational tryout** is the final step in the validation process. An instructor conducts this evaluation activity under normal operating conditions. Field tryouts of training may vary from a single block or module of training to an entire course. The training to be validated will depend largely on whether it is a new course or a block or two of an existing course that has been revised.

Purpose

The purposes of operational tryouts are to:

Determine if the training system actually works under operational conditions.
Provide feedback from a large sample of the target audience on which to base final revisions or refinements to the training system prior to it becoming operational.
Work out any implementation or operational problems, such as equipment and facilities.
Provide feedback from field units on quality.

Student selection

For operational tryouts, students are selected to participate from the target audience, using the normal student scheduling process.

Before a tryout

Before conducting the field tryouts, ensure that:

Resources such as equipment, facilities and instructors are available.
Training and materials have been revised based on the results of the small-group tryouts.
Materials are available in adequate quantities.
Students have been scheduled to participate in the tryouts and have been informed of their role.
Size of tryout class is compatible with operational conditions.

During a tryout

Conducting an operational tryout is like operating a course under normal day-to-day conditions. However, when conducting operational tryouts, you should:

Ensure that instruction is conducted in the normal operating environment.
Collect validation data such as time requirements, test results, instructor and student comments, and problem areas.
Use adequate data samples to ensure valid and reliable data.
Gather feedback from field on quality of course graduates.

Collect data

Operational tryout data is collected before, during, and after the training is provided.

Before conducting training, the instructional developer or instructor should:
- Determine if the students have met the course prerequisites and identify their entry skill and knowledge level.
- Collect data using such methods as pretests, oral examination, or by directly asking the students if they have specific skills or knowledge.

During conduct of training, the instructional developer or instructor should:
- Identify breakdowns in the training and checks student progress.
- Record the duration of the training.

After conducting training, the instructional developer or instructor should:
- Administer posttest.
- Interview students.
- Critique the training.
- Gather supervisors' critiques of graduates.

The field data collection is summarized below.

Collect data (Continued)

Stage	Data To Be Collected	Data Collection Methods
Before	Student entry skill/knowledge level	Pretest Oral examinations Student interviews
During	Number of errors students make Questions raised by students Student work samples Duration of the instruction	Observations Recording student questions Collecting work samples Written test
After	Student learning gains Student views of the instruction, materials Supervisor's critique	Posttest Student interviews Student critiques Supervisor critiques

After a tryout

When adequate numbers of operational tryouts have been conducted, you should:

Analyze the data gathered during the tryouts.
Revise the instructional system as necessary.

As with other forms of validation, continue to try out, revise, and try out as long as the quality of the training system is improved.

Section F
Finalize Training Materials

Introduction

After you have validated the training, you should finalize the training materials. During this step, you make sure that all necessary changes are made to the training materials and they are ready for implementation.

Purpose

The purpose of finalizing the training materials is to ensure that they:

Have been revised to include the most current and accurate information.
Are complete.
Are ready to use in the teaching-learning activity.

Who is responsible?

Curriculum developers are responsible for finalizing training materials. Training or single-point managers have the overall responsibility to ensure that training materials are finalized and ready for implementation.

What needs to be updated?

When finalizing training materials, update:

Plans that have been developed.
Course control documents.
Training materials.

Quality checklist

The following list of questions may help you ensure that everything is ready for implementation.

Quality checklist (Continued)

Training Material	Questions
Training Plan	Has the training plan been updated? Is the training plan complete? Has the training plan been approved? Have the training plans been distributed, as required?
Training Standard	Has the training standard been revised/changed? Has the training standard revision/change been approved? Has the training standard been approved?
Plan of Instruction	Has the plan of instruction been updated? Is the plan of instruction complete? Has the plan of instruction been approved? Has the plan of instruction been published and distributed?
Instructional Materials	Printed Materials Have the student workbooks been updated? Are the student workbooks complete? Have the student workbooks been published? Have the instructor lesson plans been updated? Are the instructor lesson plans complete? Have the instructor lesson plans been approved and published? Audiovisual Have the transparencies been updated? Are the transparencies complete? Are the transparencies ready for use? Have the slides been updated? Are the slides complete? Are the slides ready for use? Interactive Courseware Has the program been updated? Is the programming complete? Has the ICW been operationally tested?

Chapter 7
IMPLEMENTATION

Overview

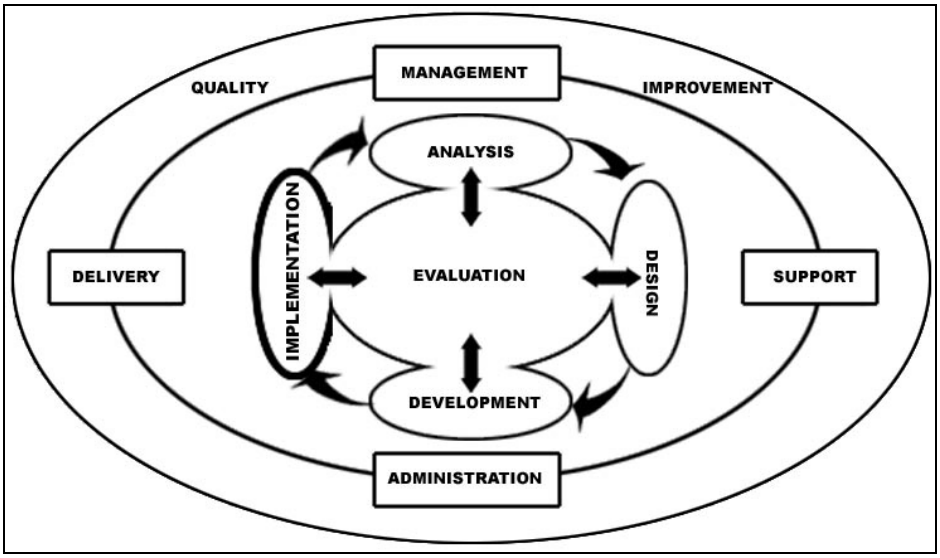
Introduction

Before you put the course "on-line," make sure the system functions are in place, instructors and supervisors are prepared to conduct and administer the training, and all of the required resources such as personnel, equipment, and facilities are available. Once the course becomes operational, you should ensure that the system continually receives the necessary support and maintenance. Also, periodically conduct an operational evaluation to ensure that the course continues to operate effectively and cost-efficiently and to produce graduates that can meet the job performance requirements.

Where are you in the process?

The training has been designed and developed and now you are ready to enter the implementation phase. An ISD model, with the implementation phase highlighted, is provided in Figure 14 to help you visualize where you are in the process.

Figure 12 Implementation Phase



Objectives

The objectives of this chapter are to:

Discuss implementation of the training system functions.
Describe the activities that occur during training implementation.
Discuss the operational evaluation process.

Where to read about it

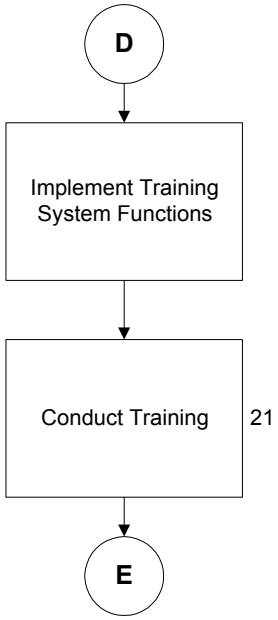
This chapter contains three sections.

Section	Title	Page
A	Implement Training System Functions	213
B	Conduct Training	226
C	Conduct Operational Evaluation	233

Implementation process flowchart

The implementation portion of the training development flowchart (Figure 7) is provided below as a quick reminder of the activities involved in the implementation process.

Implementation



Section A
Implement Training System Functions

Introduction

In most formal training environments, you will not be required to implement the training system functions, which were likely implemented when the training organization was established. Your job is to make sure someone is performing these functions in the training organization and to clearly understand how the system functions interface with the training system to support, operate, and maintain the system. System functions can be divided into management, administration, delivery, and support. This section discusses each of these functions.

Where to read about it

This section covers four topics.

Additional information

For additional information on training system management functions, see:

AFMAN 36-2234, Instructional System Development, Introduction and Implementation chapters.

Bills, C. G. and Butterbrodt, V.L. (1992). *Total Training Systems Design Function: A Total Quality Management Application.* Wright-Patterson AFB, Ohio: Aeronautical Systems Center.

Fishburne, R.P., Williams, K. R., Chatt, J.A., and Spears, W.D. (1987). *Design Specification Development for the C-130 Model Aircrew Training System: Phase I Report.* Williams AFB, Arizona: Air Force Human Resources Laboratory (AFHRL-TR86-44).

JWK International Corp. (1990). *Final Training System Baseline Analysis Report (EWOT).* Dayton, Ohio: JWK International Corp.

Additional information

Williams, K. R., Judd, W.A., Degen, T.E., Haskell, B.C., & Schutt, S.L. (1987). *Advanced Aircrew Training Systems*

(Continued)

Schutt, S.L. (1987). *Advanced Aircrew Training Systems (AATS): Functional Design Description.* Irving, Texas: Seville Training Systems (TD-87-12).

Management Function

Introduction

Initially, the training system started as a concept. With a great deal of careful planning and hard work, this concept has become a course ready for implementation. One of the key training system functions is management. Management has the overall responsibility for the training system. No matter how careful you may have been, training can be inadequate if management fails to perform its functions.

Who is responsible?

It is often thought that only supervisors or managers have management responsibilities, but that is not the case within the training organization. Each individual within the training organization has certain management responsibilities. For example:

Instructors manage the teaching-learning activity.
Instructors' supervisors manage the scheduling of courses and make sure that instructors are available and properly trained.
Instructional developers manage development of the instruction.
Development branch chiefs manage the training development process to ensure that effective, cost-efficient training is developed in a timely manner.
Managers manage the overall training programs to ensure they are meeting the users' needs.

In addition, organizations such as Resource Management, the Registrar, and Faculty Development also have management responsibilities.

Management activities

The management function is the practice of directing or controlling all aspects of the training system from the initial project planning to day-to-day training. The training system management function includes:

Planning for the design, development, implementation, support, operation, and maintenance of the training system.

Management activities (Continued)

Organizing the resources, which involves identifying, arranging, and bringing together resources such as personnel, equipment, and facilities required for the training system.
Coordinating activities between the training and supporting activities such as civil engineering, resource management, and services.
Evaluating the effectiveness and cost-efficiency of each element of the project such as personnel, milestones, budget, and production.
Reporting status and progress of the project to management and other organizations involved such as Air Force functional management, MAJCOM functional management, and HQ AETC training operations.

Examples of management activities

Following are examples of activities performed by management in support of the training system.

Activity	Examples of Tasks
Planning	Develop the management strategy for the training system. Make long-range management plans. Develop a plan to manage training development projects. Plan for system resource requirements including time, equipment, personnel, facilities, and maintenance. Plan quality improvement program to include formative, summative, and operational evaluation. Plan certification of instructors and instructors' supervisors, and continuation training programs to ensure qualification of the instructional staff.
Organizing	Establish lines of communications between the development team and management to enhance the development effort. Organize and schedule resources such as personnel and equipment to support the development effort.

Examples of management activities (Continued)

Coordinating	Establish lines of communication with supporting organizations, such as resource management, civil engineering, and logistics to ensure availability of resources.
Evaluating	Monitor established milestones, budget expenditures, and development progress against what was planned. Evaluate the process and products of each phase of the ISD process for quality. Review training and materials for accuracy, currency, and availability.
Reporting	Provide briefings on status of courses and course development projects to individuals such as plans chiefs, commanders, and functional managers. Report inspection and evaluation results such as course reviews, self-inspections, course validation, and summative evaluations. Report any identified training deficiency or supply difficulty.

Relationship to implementation

Every aspect of the training system depends on the training system management function. Its planning, organizing, coordinating, evaluating, and reporting activities all work toward ensuring the successful implementation of a training system. Without this function, the system could be ineffective and inefficient.

Support Function

Introduction

The importance of the support function in the training system cannot be over-emphasized. You can design, develop, and implement an outstanding training course, but without the necessary support, it will not be effective or cost-efficient. In most cases, you will find the support function already exists. The structure is there, "networks" have been established, and training support activities are actively supporting the training systems at your base. Although the structure is there, each time a training system is developed the support requirements for that specific course must be established. For example, a base has several courses that require seven technicians to maintain the training equipment. If you develop a new course, the additional maintenance support requirement may drive an additional maintenance authorization. So, each time a new course is developed or an existing course is revised, you must ensure that all support requirements are identified and adequately supported.

Definition

The **support function** can be defined as those long-range, as well as day-to-day, tasks performed by training support organizations in order to implement, operate, and maintain a training system. Examples of support functions are:

Maintaining equipment and facilities.
Supplying equipment parts and materials for the courses.
Providing services such as engineering, visual, and publication.

Support activities

Some of the basic support activities include:

Supplying equipment, parts, and materials.
Maintaining equipment and facilities.
Providing instructional materials.
Constructing instructional aids and facilities.
Providing funding and services.

Who is responsible?

As with other training system functions, managers have the overall responsibility for ensuring that their training systems are getting adequate support. Examples of support organizations are:

Civil Engineering
Resource Management
Visual Services
Information Management

These are only a few of the many support organizations that have support and maintenance responsibilities for your training systems. Your training systems may require many more than these. You should always be aware of the role that other organizations play.

Examples of training support tasks

Various support organizations perform many tasks in support of the training system. Examples of training support tasks are provided below.

Organization	Examples of Tasks
Civil Engineering	Constructs training and support facilities such as classrooms and test pads. Modifies existing facilities such as adding new electrical outlets and air conditioning.
Resource Management	Provides human resources such as instructors and maintenance personnel. Manages training and support equipment. Provides funding for day-to-day operation.
Information Management	Edits training material such as student workbooks, student study guides. Produces training material such as student handbooks and plans of instruction.
Contracting	Develops contracts for maintenance and other services. Processes local purchase forms to procure equipment and supplies.

Examples of training support tasks (Continued)

Organization	Examples of Tasks
Maintenance Organization	Performs quality assurance inspections on training, support, and test equipment. Performs scheduled and unscheduled maintenance on training, support, and test equipment. Fabricates trainers and training aids.
Visual Information	Develops and controls visual material such as slide and filmstrips. Manages visual equipment such as televisions, VCR, and slide projectors.

Relationship to implementation

Implementing a training system requires a great deal of planning and preparation. A part of that effort is to ensure that the necessary support functions are available. Without necessary support, you will not be able to operate the training system.

Administration Function

Introduction

Often overlooked, the administration function plays a vital role in the day-to-day operation of a training system. Management may be doing an excellent job managing a training system and the training staff may be outstanding in providing training. But, if the administration function is not working, the training system suffers. You may not be involved in any administrative activities but you should still be aware of what is being done on a daily basis by other organizations to support and maintain the training system.

What it is

Administration is the part of management that performs day-to-day tasks such as maintaining documentation, typing reports, keeping equipment, supply, and other records, and maintaining student records.

Who is responsible?

Once again, managers have the overall responsibility to ensure that the administration function is "in place." However, various training support organizations also have their own individual administration responsibility:

Registrar
Typing pool
Unit orderly room
Student squadron
Information management
Contract office (if fees are required)

Administration activities

Administration includes activities such as:

Provide administrative support for documents such as training standards, plans of instruction, lesson plans, and student workbooks.
Maintain personnel, training, and equipment records.
Type reports, letters, and messages.
Perform student support, which includes tasks such as in and out processing of students.

Administration activities (Continued)

Administer staff support tasks such as leave process, preparation and maintenance of personnel records, and administration of personnel programs.
Schedule resources such as programming of the annual TPR, scheduling students for classes and establishing equipment utilization schedules.
Track students and equipment.

Examples of administration tasks

Within a training organization there are many tasks being performed in support of the training system. Examples of organizations and some of the tasks they are performing are provided.

Organization	Examples of Tasks
Registrar	Track student entries. Maintain student status. Print and distribute course status reports.
Typing Pool	Type course control documents such as training standards and plans of instructions. Type course materials such as lesson plans and handouts. Type student materials such as study guides and workbooks. Type reports and summaries.
Information Management	Edit training materials. Publish training materials. Maintain record of materials.
Student Squadron	In- and out-process students in the training activity. Maintain health and welfare programs for students. Provide student billeting.
Unit Squadron	Perform administrative functions for training staff such as processing leaves, maintaining personnel training records, and other functions. Administer programs such as suggestions, awards and decorations, and others.

Relationship to implementation

The training system administration function should be "in place" before successfully implementing a training system. For example, the training materials must be produced and available, students must be scheduled and tracked, and the health and welfare concerns have to be addressed.

Remember, you always need administrative support for your training system.

Delivery Function

Introduction

During design and development of the training system, you must take special care to ensure that the appropriate delivery method is selected and is ready to function when it's time to implement the training. The delivery function, like the other two functions, is also critical to the training system.

What it is

The **delivery function** is defined as the means or methods by which training is provided to the students. Examples of delivery functions include:

Instructors
Computers (which includes ICW, CAI and CMI)
Training devices including simulators, part-task trainers, maintenance trainers, and mockups
Satellites
Programmed text
Career development and specialized courses
Job aids

Who is responsible?

Individuals responsible for the training delivery function are:

Managers – responsible for ensuring adequate planning and analysis before the delivery method is selected. Once the method has been selected, management must make sure it is adequately supported.
Instructional developers – responsible for selecting the appropriate delivery method for training.
Instructors and instructors' supervisors – responsible for using the selected method to deliver training and evaluating its effectiveness.

Ensuring readiness

At this point, the delivery function should be fully developed and operational. Validation will have given an indication of the suitability and readiness of the delivery system; however, prior to implementing the instructional system you should "check it out" to be sure that everything is ready. You need answers to questions about the delivery function, such as:

Are there adequate instructors to support the training requirements?
Have the instructors been qualified, and are they certified to deliver the instructions?
Are the student workbooks printed in adequate numbers?
Is the necessary equipment available and operational, such as computers, projectors, and simulators?
Has the programming of the ICW been completed?
Have slides and/or transparencies been produced?

Relationship to implementation

Simply stated, without the delivery function you cannot implement training.

Section B
Conduct Training

Introduction

To this point, managers have spent considerable time planning the training system, securing resources, managing the training development process, and arranging for system support. Instructional developers have analyzed the tasks, designed the training system, and developed and validated the training. You have now reached the point of training implementation.

During implementation, management continues to plan and manage the training system; instructional developers monitor and refine training as necessary; the instructional staff conducts and evaluates the training; training evaluators periodically conduct operational evaluation; and the support personnel continue to support and maintain the training system.

Where to read about it

This section covers two topics.

Additional information

For additional information on conducting training, see:

AFMAN 36-2234, Instructional System Development, Implementation chapter.
AFMAN 36-2236, Handbook for Air Force Instructors.

Preparations for Conducting Training

Introduction

Preparing to conduct training starts with the initial planning for the training system and continues throughout the analysis, design, and development phases of the ISD process. As you are getting ready for implementation, you should ensure that everything is ready to support the training.

Why make preparations?

Adequate preparation produces graduates who can meet their job performance requirements. Inadequate planning and preparation can result in complete failure of a training system. For example, if the instructors have not been qualified in the subject matter, they may not be capable of providing the training necessary for the students to achieve the objectives. Thus, the training system produces students who can't do the job. These checks are also a quality assessment of the development process and an evaluation of the ISD application to this point.

Who is responsible?

Everyone involved in the support, operation, and maintenance of a training system shares some of the responsibilities for ensuring that everything is ready for implementation. This includes:

Managers
Instructional developers
Instructors

What should be checked?

During final preparations to conduct training, each component of the training system should be checked "one last time" to ensure that everything is ready. Some of the items to be checked are:

Equipment

Training, support, and test equipment should be available in adequate numbers and in operational condition.
Logistic support, including maintenance and spare parts, should be available for all training, support, and test equipment.
A "backup" system is available if the primary system is unavailable or not usable.

What should be checked? (Continued)

Facilities

Training and support facilities should be available.
Modifications to facilities such as electrical and air conditioning should be complete.
Student support facilities should be available and adequate.
Alternative facilities should be available to support "backup" system, as needed.

Human Resources

Adequate personnel must be available including instructional developers, instructors, maintenance personnel, students, etc.
Instructors and instructors' supervisors must know their importance and role in the training system.
Instructors must be qualified and certified to teach the courses.
Instructors must be assigned to classes.
Maintenance personnel should be properly trained.
Students must be scheduled for the classes.

Funds

Adequate funds should be available to meet implementation cost and the cost associated with daily operation of the course.

Time

Instructional developers should have had adequate time to develop effective and efficient training to meet the users' need date.
Instructors should have enough lead time to get certification.

Materials and Supplies

Instructional and student materials should be available in adequate quantities to support training.
Training and office supplies should be available in adequate quantities to support training implementation.

Conducting Training

Introduction

Because of poor planning and lack of adequate preparation, the conduct of training has often been viewed as a difficult task. However, if you have planned well and made adequate preparations, you should have very few problems while conducting the training.

Why conduct training?

The purpose of conducting training is to impart the necessary skills, knowledge, and attitudes required for the graduates to meet job performance requirements and to prepare them for further progress through OJT.

Who is responsible?

The following are examples of people responsible for conducting training and their respective tasks.

Managers have the overall responsibility for the daily operation of a training system. This responsibility includes managing the support, operation, and maintenance of the system.
Support organizations have responsibilities to provide the necessary logistic support and services to maintain the system.
Instructional developers have the responsibility to ensure that deficiencies identified during operation are corrected and all materials are updated as necessary.
Instructional staff are directly responsible for conducting training and evaluating students.
Instructional evaluators have the continuing responsibility for evaluating a graduate's technical performance throughout the life cycle of the training system.

As you can see, managers and support activities have responsibilities for the operational system. However, the focus of primary responsibility is now on the instructional staff.

Before you begin

Consider this situation. A new part-task trainer has been installed in one of the classrooms in your training facility. When students enter the classroom, you turn on the trainer. It trips the electrical circuit breaker; you don't understand why. You performed an operational check yesterday and there was no problem with the circuit breaker. Further investigation reveals that when the equipment in the next classroom is on, it overloads the electrical circuit. This is an easy problem to fix, but a bad time to find the problem.

The above situation should not have occurred. Between the manager and instructor supervisor, every aspect of the training system should be checked out before implementing the training, if possible. Examples of areas that you may want to look at (if you haven't already done so) are:

Personnel including students, instructors, and support personnel such as maintenance.
Facilities including training and support.
Equipment including training, support, and test.
Supplies including training and support equipment, and spare parts.
Materials including training and student handouts.
Schedules including facilities, equipment, students, and instructors.

Conducting the training

Once the training system becomes operational, it will remain so until there is no longer a need for the training or the course has gone through so many revisions that the course is given a new course number. When conducting training, make sure the system continues to operate effectively and cost-efficiently, producing graduates who can meet job performance requirements. During the operation of the training system, there are ongoing activities that ensure system integrity.

Resource management is probably the single most critical issue for training managers as well as instructors. You should manage resources. For example:

Conducting the training (Continued)

Instructors' supervisors must schedule students for training in a timely manner to ensure that students do not remain in an ineffective status any longer than necessary. Instructors, when not in the classroom, should be scheduled to work on course-related items such as writing questions for the test pool or posting changes to technical orders used in their units or blocks of instruction.

Managers must make sure that equipment is available, in adequate quantities, and in an operational condition. Unneeded equipment should be turned in to supply or returned to lender if it was borrowed.

Staff development is an activity that goes on continually while training is being conducted. There is always someone who needs to attend a staff development course. For example, instructors and supervisors must periodically attend courses such as Test and Measurement, and ISD. These courses, as well as others, continue to help the staff to develop professionally.

Conducting training is the centerpiece to system integrity. No matter what has been done to this point, the training system can fail or be rendered ineffective or inefficient if the training is not properly conducted. There are many items that will help you conduct training.

Training should always be student-centered. Never allow the training to be focused on the instructor.

Instructors are not allowed to change the training at will. They must follow the plan of instruction.

Instructors must always perform professionally in the teaching-learning environment. For example, instructors should be willing to assist students when necessary and within limits.

Instructors should always be qualified to instruct and be certified in the units/blocks they are assigned to teach.

Evaluation maintains the quality of the training system. During the conduct of training, operational evaluation is continually performed to ensure the quality of the training system. It is covered in detail in the next chapter of this handbook.

Conducting the training (Continued)

To conduct a good training program, **don't forget** what you learned in the Technical Instructor Course (TIC) or Academic Instructor School (AIS). The information you learned in these courses will help you to provide better training. Also, you may want to get a copy of AFMAN 36-2234, which can help you be a better trainer.

Section C
Conduct Operational Evaluation

Introduction

After the instruction is validated, a summative evaluation has been completed, and the system functions are in place, the instructional system is ready for implementation. Once the system is implemented and starts producing graduates, it's time to begin conducting operational evaluations. Operational evaluation is a continuous process that assesses how well course graduates are meeting the established job performance requirements.

Objectives

The objectives of this chapter are to:

Describe the operational evaluation process.
Explain internal evaluation.
Explain external evaluation.

Where to read about it

This section contains three topics.

Operational Evaluation

Introduction

Evaluation is a continuous activity that is integrated throughout each stage of ISD, beginning with analysis and continuing throughout the life cycle of the system. Its focus is quality improvement. The last stage of the evaluation process is **operational evaluation**.

What it is

Operational evaluation is the continuous process of gathering and analyzing internal and external feedback data to ensure that the system continues to effectively and cost-efficiently produce graduates who meet established job performance requirements. It is a quality improvement activity.

Purpose

The two main purposes of operational evaluation are:

To ensure that graduates continue to meet established job performance requirements.
To continually improve system quality.

What should you look for?

When evaluating, look for both strengths and weaknesses in the system. Focus on:

How well the graduates are meeting job performance requirements.
Whether training is being provided that is not needed.
Whether any needed training is not being provided.
How well each system component is contributing to overall system quality.
Ways to improve the graduate's performance as well as the system.

Operational evaluation activities

The two operational evaluation activities are:

Internal evaluation – Gathers and analyzes internal feedback and management data from within the training environment to assess the effectiveness and quality of the training process. The instructional developers and instructors normally gather internal evaluation data.

External evaluation – Gathers and analyzes external feedback data from the field to assess graduates' on-the-job performance in an operational environment. Most external evaluation data is gathered by training evaluators from the organization providing the training or is provided by the graduates and their supervisors directly from the field. However, in some cases, external evaluation data is gathered and provided to the organization by both Air Force and non-Air Force inspection and evaluation teams, consultants, advisory bodies, Board of Visitors, accrediting agencies, and professional certification groups.

Additional information

For additional information on operational evaluation, see:

AFMAN 36-2236, Handbook for Air Force Instructors.
Briggs, L. J. and Wager, W. W. (1981). *Handbook of Procedures for the Design of Instruction* (2nd Ed.). Glenview, Illinois: Harper Collins Publishers.

Internal Evaluation

Introduction

Internal evaluation activities begin with implementation of the instructional system and continue throughout the life cycle of the training system. Some organizations call this evaluation activity a "course review." Internal evaluations look at the training system from within to determine system effectiveness and quality.

What it is

Internal evaluation is the acquisition and analysis of internal feedback and management data, such as test data, student critiques, instructor comments, and data correlation from within the training system.

Purpose

The purpose of internal evaluation is to improve the effectiveness and quality of the training system.

Possible causes of problems

Although training systems are validated prior to implementation, students may still have difficulty with the instruction during day-to-day system operation. Possible causes of student problems are:

Instructors do not follow the POI or course syllabus.
The developed course is different from the course that is actually implemented.
Resources required to support, operate, and maintain the system are inadequate.
Instructional materials are not correlated.
Students do not meet course prerequisites.
Instructors not adequately qualified.

Periodic internal evaluations may identify weaknesses (problems) as well as strengths of the training system.

Data collection

Several methods of collecting internal evaluation data are listed on the following page.

Data collection (Continued)

Data Collection Methods	Purpose
Review Course Control Documents	To determine if there are any discrepancies between the planned course and the course that was actually implemented.
Review Resources	To ensure that facilities (training and support) are available and adequately maintained. To ensure that equipment (training, support, and test) and supplies are available. To ensure that human resources (instructional developers, instructors, students, and maintenance personnel) are available. To ensure that there is adequate time (adequate course length, sufficient time to maintain the course). To ensure that funds are adequate to support, operate, and maintain the course.
Visit Instructional Facilities	To evaluate the quality of implemented instruction (ensure the visit is long enough to ensure observation of representative instruction). To check equipment, instructional media, training aids and devices for condition, operation, and appropriateness. To check instructional literature such as study guides and workbooks for quality and availability.
Evaluate Instructor Performance	To check if instructor follows the plan of instruction, uses instructional media properly, responds to student needs, and is qualified to teach. To check instructor evaluation forms to determine if noted weaknesses have been corrected.

Data collection (Continued)

Data Collection Methods	Purpose
Monitor Measurement Program	To check the measurement program for compromise. If a test has been compromised, it cannot provide useful feedback. To monitor the measurement program to ensure quality. To evaluate training in terms of student performance. Use performance measures to determine students' achievement of objectives.

Conducting an internal evaluation

Collect sufficient internal evaluation data for the analysis. Insufficient data may skew the analysis results; possibly leading to incorrect decisions being made. Job aids can be used to gather internal evaluation data. An example of a job aid is provided below.

Conducting an internal evaluation (Continued)

Check	Data Source
	Does the POI/course syllabus reflect the operational course?
	Is the POI/course syllabus current and accurate?
	Does the POI/course syllabus provide adequate guidance?
	Do the lesson plan and POI/course syllabus agree?
	Does the lesson plan reflect what is being taught in the course?
	Is the lesson plan current and accurate?
	Do training materials support the lesson plan and POI?
	Do training facilities meet system requirements?
	Do support facilities meet system requirements?
	Does training equipment meet system requirements?
	Is the training equipment adequately maintained?
	Does support equipment meet system requirements?
	Are instructors teaching according to the lesson plan?
	Are instructors oriented and trained to execute the courses, i.e., have they been given the "big picture"?
	Are they adequately trained?
	Do tests adequately measure the objectives?
	Is the test data thoroughly analyzed?
	Can improvement be made in the course?

Student reaction

The following example of a questionnaire is designed to obtain student feedback.

STUDENT REACTION TO INSTRUCTION

PERIOD_____DATE_____

INSTRUCTOR_____STUDENT_____

One way instruction is improved is by sampling student reaction to the instruction. Please answer the following questions.

1. Prior to this instruction, my experience in this area was
   _____ extensive
   _____ moderate
   _____ little or none
2. Did your knowledge of the subject increase as a result of the instruction?
   _____ yes
   _____ no
3. If your knowledge increased as a result of the instruction, to what extent did it increase?
   _____ not applicable (my knowledge didn't increase)
   _____ slightly
   _____ moderately
   _____ extremely
4. Based on my experience, the level of instruction was
   _____ too advanced
   _____ about right
   _____ too elementary
5. The organization of the instruction was
   _____ very helpful
   _____ helpful
   _____ not very helpful
6. The lecture outline (main points of instruction) was
   _____ very helpful
   _____ helpful
   _____ not very helpful
7. Audiovisual aids were
   _____ of great value
   _____ valuable
   _____ of little or no value
   _____ not used, but could have helped
   _____ not used and not needed
8. Answers to student questions were
   _____ meaningful
   _____ somewhat helpful
   _____ not helpful
   _____ not applicable (no questions asked)
9. Should the subject matter covered be changed?
   _____ yes (please explain below)
   _____ no
10. Should the method of instruction be changed?
    _____ yes (please explain below)
    _____ no

STUDENT REACTION TO INSTRUCTION (Continued)

11. Overall, the instruction was
    _____ outstanding
    _____ good
    _____ fair
    _____ poor
12. Instruments (including tests) to evaluate student performance were
    _____ outstanding
    _____ good
    _____ fair
    _____ poor

COMMENTS, EXPLANATIONS, OR RECOMMENDATIONS

Data analysis

Before beginning analysis of the data, ensure that:

Data has been collected from each component of the training system.
Adequate data samples are collected in order to validate the reliability of the findings.

Following are some methods of analyzing the internal evaluation data.

Compare the training standard with the POI/course syllabus to determine if the requirements of the standard are being met.
Compare POI/course syllabus with operational course to determine if the planned and operational courses are the same.
Review POI/course syllabus, LP, and instructional material to determine if they are current, adequate, and in agreement.
Compare stated resource requirements with actual resources to determine if adequate resources are available to support, operate, and maintain the training system.
Review records to determine if instructors are qualified to teach the course.
Review test data to ensure that students are meeting course objectives.
Analyze test data to determine if test items are valid and reliable.

Revising the training system

After internal evaluation data is collected and analyzed, the next stage is to correct deficiencies in the training system. If revisions can be made to correct identified problems, they should be made in a timely manner in order to receive the greatest benefit from the changes.

Revisions resulting from the analysis may require re-entry into an earlier phase of the ISD process to correct the problem(s). The need to re-enter an earlier phase of ISD is determined by the nature and scope of the revision. For example, changing a test item or adding time to a unit of training may not require you to re-enter an earlier phase of ISD. However, adding a new piece of equipment to the course would more than likely require you to do so.

External Evaluation

Introduction

How well graduates meet job performance requirements is learned through **external evaluation**. This evaluation activity relies on input from the field to determine how well graduates are performing.

What it is

External (field) evaluation is the process of gathering and analyzing data from outside the training environment in order to determine how well recent graduates are meeting job performance requirements.

Purpose

The purpose of external evaluation is to determine if recent graduates of the course:

Can meet job performance requirements.
Need all of the training they received.
Need any training they did not receive.

Possible causes of problems

Some possible problems that may be identified during external evaluations are:

Test did not measure graduates' ability to meet job performance requirements.
Objectives do not reflect job performance requirements.
Job performance requirements were incorrectly identified during task analysis.
Job performance requirements changed after task analysis.

Collecting data

Several methods of collecting external evaluation data are listed below.

Questionnaires

Introduction

Questionnaires are effective, cost-efficient evaluation tools. The discussion on questionnaires will focus on:

Advantages and disadvantages of questionnaires.
Types of questionnaires.
How to prepare and distribute questionnaires.
Analysis of data gathered using questionnaires.

Purpose

The purpose of using questionnaires is to:

Determine the ability of recent graduates to perform specific tasks on which they received training.
Identify the specific nature of any deficiency.
Determine what tasks graduates are actually performing.
Identify what training is not needed for on-the-job performance.

Advantages

Advantages of questionnaires include:

They are comparatively inexpensive to administer.
They can be used to collect large samples of graduate and supervisor data.
They yield data that can be easily tabulated and reported.
Respondents give their opinions freely.

Disadvantages

Disadvantages of questionnaires include:

They may not be the most reliable form of evaluation; data validity depends on preparation and distribution.
Communication is one-way; respondent may not understand some of the questions.
They may not ask the most relevant questions.
They collect only opinions, which may not be as reliable as other methods of collecting external data.
Developing effective and reliable questionnaires may be costly and require extensive experience.
Low return rates and inappropriate responses affect accuracy.

Types of questionnaires

Two types of questionnaires can be used to collect external evaluation data:

One is for the graduates' immediate supervisor. However, responding may be delegated to the graduates' trainer. The other questionnaire is for the graduates. This questionnaire is designed to find out what graduates think about the training they received.

Preparing questionnaires

Well-constructed questionnaires that are properly administered are extremely important to the field evaluation process. The following table identifies the five basic stages of questionnaire development.

Stage	Activity
Stage 1	Define purpose of questionnaire. Focus only on relevant information.
Stage 2	Determine specific information to be collected. Specify exactly what is needed in a list of objectives.
Stage 3	Develop questions that ask for specific information such as: What conditions/equipment are required to do the job. Exact action to accomplish the performance. Standards of performance. Results of performance.
Stage 4	Consider motivational factors when developing questionnaires. You want the respondents to answer fully and conscientiously. Questionnaires will likely motivate if you: Explain the purpose of the questionnaire. Tell the respondents how they can benefit from answering the questionnaire. Write clear and concise instructions. Make questionnaire format uncluttered and easy to answer. For example, using boxes for check marks should make the questionnaire easier to answer.

Preparing questionnaires (Continued)

Stage	Activity
Stage 4 (Continued)	Arrange the questionnaire in logical order. Ask specific questions.
Stage 5	Test the questionnaire on sample respondents. Ask them to: Evaluate the cover letter. Check instructions and questions for clarity. Explain how they feel about answering the questions. Revise the questionnaire, if necessary, before distribution.

Note: Questions can be taken directly from the task statements in the training standard.

Guidelines for developing questions

Guidelines for developing effective questions are:

Use *closed-end* questions when you want the respondent to choose answers from a small number of possibilities. This makes tabulation easy but may not give the range of answers desired.
Use *open-end* questions when you don't know all the possible answers. The respondent will probably suggest possibilities.
Word questions to the respondent's level of understanding.
Use vocabulary and concepts that are easy for the respondent to understand.
Limit each question to one aspect of a topic.
Decide on the logical order of the questions (task order, general to specific). Each question increases the respondent's frame of reference and further establishes upcoming responses.
Avoid questions that make it easier to answer one way or another.
Avoid questions that show biases or exceptions.
Word questions so they will not threaten the respondents.
Supplemental "information-seeking" questions may be used. Such questions may ask how much time the graduate spends on individual tasks or what equipment or materials the graduate uses.

Guidelines for constructing questionnaires

When constructing a questionnaire, several guidelines should be considered.

Provide short, concise, and specific directions for completing the questionnaire. The directions should be printed in heavy, bold type, if possible.
Provide space for the respondent's name, title, organization, and location.
Number the questionnaires to allow for administrative control.
Whenever possible, allow the respondent to use the same type marking for all questions. For example, one of the best methods is to allow use of check marks for responses.
Arrange "yes" and "no" responses vertically rather than horizontally.

Correct	**Incorrect**
Yes___	Yes ___ No ___
No __	

Number each page of the questionnaire.
The questionnaire should be easy to read and mark. Further, it should be printed.
Print on both sides of the pages to conserve materials, if possible.
Send self-addressed return envelope with the questionnaire.
Fold the questionnaire in such a manner that the respondent can refold it the same way to place it in the return envelope after completion.

Guidelines for preparing cover letters

Each questionnaire should have a cover letter. When developing the cover letter, ensure that it:

Explains the purpose of the questionnaire and its importance to improving instruction.
Includes a statement that assures the respondent that the information will be treated confidentially.
Includes a statement that the evaluation is being conducted per AFR 50-38.

Guidelines for preparing cover letters (Continued)

Provides information on how to return the questionnaire.
Indicates the approximate time required to complete the questionnaire.
Shows the date the questionnaire was mailed and the recommended return date.
Uses appropriate letterhead stationery signed by a responsible authority.
Keep it brief.

Before you distribute the questionnaire

Before distributing the questionnaire, it should be administered to a small number of select individuals to:

Provide valuable feedback on the quality of the questionnaire.
Preclude acquiring misinformation resulting from the administration of a faulty questionnaire.
Allow correction of problems in the questionnaire before distribution.

Distribution of questionnaire

Distribution of the questionnaire is a critical aspect of external evaluation; you just don't pick a few graduates' names and drop a questionnaire in the mail to them. You **plan** the distribution to help ensure a random sample so that the data collected is valid and reliable. When distributing the questionnaire, you should:

Decide to whom you are sending the questionnaire – recent graduate, his or her supervisor, or both. You may collect important information from both.
Select a representative sample to ensure valid results. Graduates may perform different tasks or their job requirements may vary depending on the major command, geographic location, or organization level; therefore, questionnaires should be distributed to each area as evenly as possible.
Determine how many questionnaires you need to mail out. That decision is based on:
Expected response rate.

Distribution of questionnaire (Continued)

Level of confidence (a statistical consideration which means the size of the sample required for you to be, say, 95 percent sure the sample truly represents the larger population). The graduate sampling chart on the following page shows how to determine the number of questionnaires you need based on this consideration.

Decide when to distribute the questionnaires. Timing is critical. Usually, questionnaires should be sent to the graduates within three to six months after graduation. Beyond six months, it may be impossible to tell whether the graduate learned the skill or knowledge in the course, or on the job. If the questionnaire is sent too early, the graduate may not have had time to perform many of the tasks that were taught in the course.

To ensure that sufficient numbers of the questionnaires are returned for analysis, contact non-respondents and encourage their response.

GRADUATE SAMPLING CHART

Course Graduates (During Sampling Period)	Sample Size 95% Confidence*	Sample Size 90% Confidence	Sample Size 80% Confidence
10	10	10	9
20	19	19	18
40	36	35	32
60	52	49	44
80	67	62	54
100	80	73	62
120	92	83	69
160	114	101	81
200	133	115	90
250	154	130	99
300	171	142	106
350	187	153	112
400	200	161	116
450	212	169	120
500	222	176	123
600	240	186	129
700	255	195	133
800	267	202	136
900	277	208	139
1,000	286	213	141
1,500	316	229	148
2,000	333	238	151
2,500	345	244	154
3,000	353	248	155
3,500	358	251	157
4,000	364	253	157
4,500	367	255	158
5,000	370	257	159
10,000	383	263	161
25,000	394	268	163
100,000	398	270	164

How to use the graduate sampling table

The table can be used as shown in the following example:

Annual course production is 4,000 - 95% confidence level desired.* Estimated return rate of usable questionnaires is 85%. From the table, 364 usable questionnaires are required. Therefore, this figure should be 85% of the questionnaires to mail out. The number of questionnaires to mail is computed as follows:

$$\frac{85\%}{100\%} = \frac{364}{X}$$

$X = \frac{364 \times 100}{85} = 428$ = number of questionnaires to mail

* It is recommended that the 95% confidence level be chosen. This is the level commonly used in business decisions.

Data analysis

When a sufficient number of completed questionnaires have been returned, you should begin analyzing the data. In this process, the data is:

Compiled.
Collated.
Analyzed (data from each command should be analyzed together).

Pay special attention to:

Notes made by respondents on the questionnaires.
Answers to supplemental questions that were included in the questionnaire.

Use with caution any data that contain such obvious errors as:

Halo effect – indiscriminate rating of all items positively.
Central tendency – indiscriminate rating of items in the center of the scale.

Examine the responses to ensure, insofar as possible, that the information accurately reflects the opinion of the graduates and their supervisors.

Reporting the findings

After completing data analysis, the findings should be reported. The report should include information such as:

Background information on the course that was evaluated.
Scope of the evaluation.
Tasks evaluated.
Analysis results.
Recommendations.
Milestones for corrective actions, if applicable.

Now that the report is complete, your last actions are to distribute the report and follow up.

Field Visits

Introduction

Field visits are a very effective method of conducting external evaluations. A training evaluator, often assisted by an instructional developer or instructor normally conducts them. Ideally, field visits should include specialists who are familiar with the graduates' jobs. However, in most cases this is not possible due to limited TDY funds, scheduling constraints, and number and variety of graduates to be interviewed.

Purpose

The purpose of a field visit is to get first-hand information on the graduates' assignment, utilization, and proficiency on the job, and to validate information gained from other evaluation activities.

Advantages

Advantages of field visits are:

Graduates and supervisors on the job normally talk freely.
Guidance and information about the evaluation is given directly to graduates and supervisors.
Information is gathered first-hand by the evaluator. Any questions or assumptions can be clarified.
Field visits help validate questionnaire data.
External evaluations build rapport between the training activity and the user.
Additional information can be gained by observing nonverbal messages and asking leading or probing questions.

Disadvantages

Disadvantages of field visits are:

They are time-consuming. Travel to several different bases requires considerable time. Interviews and observations also require a lot of time if they are done correctly.
The sample is limited. Since the evaluator only goes to a few bases, the number of interviews and observations conducted are limited.
The cost is high. Field visits require evaluators to spend limited TDY funds to travel to the various bases.

Disadvantages (Continued)

Information gathered by the evaluator can be subjective and biased.
Graduates may feel they are being scrutinized.
Evaluators are not always skilled at interviewing and observing.
Graduates may feel intimidated by a higher ranking evaluator and rate more positively than they actually feel.

Data collection

Two methods of collecting data are:

Interviews
Observations

Evaluators should interview recent graduates and their supervisors and observe the graduates' on-the-job performance when possible. However, observations are almost useless unless the observer is familiar with the tasks being performed.

Preparing for the field visit

Visits to the field to collect evaluation data should be adequately planned. Adequate planning should ensure that useful data is gathered. To prepare for the visit, you should:

Develop a list of questions to get honest, pertinent answers and to keep the discussion focused.
Determine the bases to be visited.
Establish the schedule for the visit.
Select the individuals to be interviewed and observed.

Conducting the field visit

The following are some of the tasks to be performed during the field visit.

Inform graduates and supervisors of the purpose of the visit. Tell them that their answers will furnish valuable information for improving the training.
Interview the recent graduates and their supervisors. Supervisors should know how well the graduate has performed on the job.
Determine graduate's proficiency.

Conducting the field visit (Continued)

Determine how the skills learned during training are being used.
Find out how the graduates are progressing on OJT.
Guide the interviews with your list of questions. (As the interview progresses, you may need to add, delete, or revise questions.)
Take accurate and complete notes, especially on information that is freely given.
Have the supervisor rate the graduates' performance.
Observe graduates perform tasks. This may not be beneficial if the training evaluator does not have job or task knowledge.
Take careful notes on the graduates' performance. After the task has been completed, ask questions to clarify actions taken by the graduate during task performance.

Data analysis

Data collected from interviews and observations are analyzed in the same manner as questionnaires – that is, compiled, collated, and analyzed by major command.

Reporting the findings

The results of the field visits and questionnaires should be combined and reported in the Training Quality Report (TQR). The information gathered during field visits is not normally used or reported independently. The analysis results of the questionnaires and field visits are compared in order to validate the findings.

Job Performance Evaluations

Introduction

Job performance evaluations are accomplished jointly by the training activity and the using command in the operational environment, at representative Air Force bases.

Purpose

The purpose of job performance evaluations is to determine how well recent graduates meet the using command's job performance requirements.

Advantages

Advantages of job performance evaluations are:

Evaluations are conducted on the job by the supervisor.
Evaluations are very thorough.
The supervisor submits reports on a weekly basis, which ensures an accurate assessment of the graduates' performance.
Data can be used to validate other forms of field evaluations.

Disadvantages

Disadvantages of job performance evaluations are:

It usually takes eight to ten weeks to conduct the evaluation.
The supervisor reports progress weekly.
The evaluator makes at least two TDYs to each base.
The sample is limited.
They normally focus on a single command.

Data collection

Data is collected via field reports submitted by the supervisor to an evaluation element for analysis. These reports "recap" the progress made during the previous week.

Preparing for the evaluation

As with any evaluation method, you should make adequate plans before starting. Planning tasks include:

Select recent graduates and their supervisors to participate in the job performance evaluation.
Allot enough time in the schedule to meet with the supervisor and the graduates to explain job performance evaluations and get the supervisor's commitment to support the evaluation.
Determine tasks to be evaluated based on the training standard. The criteria of performance is the training standard.
Establish evaluation milestones.

Conducting job performance evaluations

Once the participants have been selected and briefed on the process and its importance, it's time to begin the evaluation. The evaluation consists of the following activities:

The supervisor evaluates and records the graduates' performance on each task performed.
The supervisor reports, on a weekly basis:
- Tasks performed.
- Frequency of performance.
- Time required to perform the tasks.
- Equipment used.

Data analysis and reporting

When the evaluator receives the job performance reports from the supervisor, they are analyzed to determine how well the graduates are performing the tasks they were taught during the course. Evaluators should watch for reports that indicate:

The graduate can't perform a task learned in the course.
The graduate requires excessive help to perform the task.

In these situations, data analysis should focus on determining why the graduate is not able to meet job performance requirements.

Since the job performance evaluation is normally conducted in conjunction with the other forms of field evaluations, the results of data analysis are included in the TQR.

Other Sources of Evaluation Input

Other data sources

Other external data sources that can be used to evaluate the graduates' job performance are:

Inspection team (IG) reports – AF and MAJCOMs periodically inspect instructional activities to determine their effectiveness. Other inspections conducted by these teams may also discover related problems. Use this source of data to determine if graduates are meeting their job performance requirements. Take appropriate action to correct deficiencies. One example of an IG report is the Functional Management Inspection (FMI).

Standardization/evaluation team findings – Standardization/evaluation teams periodically inspect instructional activities to determine their effectiveness. Analyze findings indicating a problem and take appropriate action to correct the deficiencies.

AF Form 1284, Training Quality Report (TQR) – The supervisor of recent graduates reports strengths and weaknesses of the training the graduates of the course received. The training activity should respond to any deficiencies identified in the TQR. Note that one or two TQRs by themselves may or may not be justification to change or revise a course. Use problems identified in the report to validate findings of other forms of evaluation methods.

Chapter 8
EVALUATION

Overview

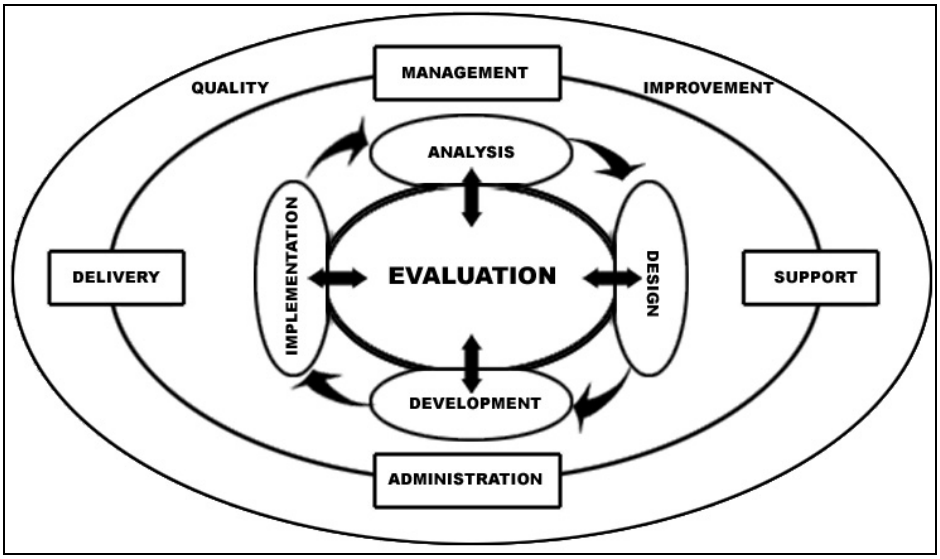
Introduction

Evaluation is integrated throughout each activity of the instructional development process. It starts in the planning stage with development of an evaluation plan and continues for the life cycle of the training system. The focus of evaluation is continuous improvement in training system quality.

Where are you in the process?

The ISD model, with evaluation highlighted, is provided in Figure 15. As depicted in the model, each stage in the ISD process involves evaluation activities.

Figure 15 Evaluation



Objective

The objective of this chapter is to:

Summarize formative evaluation.
Summarize summative evaluation.
Summarize operational evaluation.

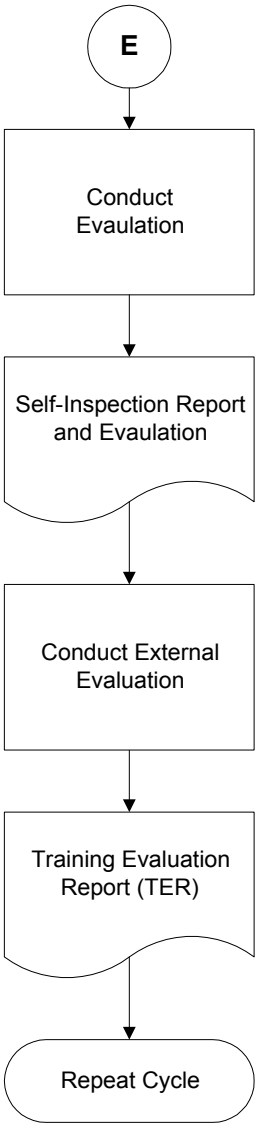
Where to read about it

This chapter contains three sections.

Evaluation process flowchart

The operational evaluation portion of the training development flowchart (Figure 7) is provided below as a quick reminder of the activities involved in the operational evaluation process. As a reminder, the number on the flowchart represents the evaluation activities where the Technical Training Management System (TTMS) can help support the ISD process.

Evaluation (22)



Additional information

For additional information on evaluation, see:

Previous chapters in this handbook.

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Section A
Formative Evaluation

Introduction

The **formative evaluation** process begins during analysis and continues through small-group tryout in the development stage of ISD. Within each stage – analysis, design, development, and implementation – formative evaluation seeks to improve the quality of the activities and products of ISD. In some organizations, formative evaluation is equated to four stages of validation – technical accuracy reviews, individual tryouts, small-group tryouts, and operational tryouts.

What it is

Formative evaluation is a form of evaluation designed to collect data and information that is used to improve the activities and products of the ISD process while the system is still being developed. Formative evaluation is also used when the design or development phases are reentered in order to update or revise the system.

Formative evaluation activities

Formative evaluation includes the following activities:

Process Evaluation
Process evaluation ensures quality in the analysis, design, and development activities.
It checks each activity against standards, or metrics, established during ISD project planning, to assure process quality, while continually seeking improvements within each activity. Process evaluation enables instructional developers to "form" an effective and efficient training system based on quality principles.

Product Evaluation
Product evaluation is an integral part of each stage of the ISD process. Product evaluation focuses on the products of the analysis, design and development activities such as task lists, objectives, tests, plans of instruction and training materials. During product evaluation the focus is again on quality. Products are measured against standards and metrics established in the planning stage of ISD to ensure quality. Product evaluation also

Formative evaluation activities (Continued)

helps form a total quality training system. Two activities of product evaluation are:

Validation, which takes place during training development and is the final activity in the formative evaluation process. This component, which is discussed in Chapter 6, forms the training system by trying out instruction on individuals and small groups when possible and if applicable. Validation identifies quality improvements that should be made to the instruction prior to implementing the system.

Quality control, which starts in the initial stages of ISD planning with the strategy of controlling quality, and continues throughout training analysis, design and development. This process ensures that each activity such as equipment acquisition, facility construction, etc., is based on quality principles.

Developmental Test and Evaluation (DT&E)
DT&E is an active part of training system development. As a formative evaluation activity, it is conducted to demonstrate that training system equipment design and development is complete, design risks have been minimized, and the system meets performance requirements. It ensures the effectiveness of the manufacturing process, equipment, and procedures.

Operational Test and Evaluation (OT&E)
OT&E completes the formative evaluation process for training system equipment. This formative evaluation activity evaluates the system's operational effectiveness, maintainability, supportability, and suitability. It identifies any operational and logistic support deficiencies, and the need for modification. In addition, OT&E provides information on organizational structure, personnel requirements, support equipment, doctrine, training and tactics. It should also provide data to verify operating instructions, maintenance procedures, training programs, publications, and handbooks.

Formative evaluation activities (Continued)

Site Readiness Reviews

The site readiness review is a formative evaluation activity that focuses on evaluating the readiness of the "bed-down" site for the training system. This evaluation ensures that the site, including training facilities and support equipment, is ready for OT&E of the system. Site readiness reviews help ensure training system effectiveness.

Relationship of the activities

Each formative evaluation activity contributes to the overall quality of the training system. They combine to ensure that:

Training development and revision activities are effective.
Training is cost-efficient.
The products of each development activity meet quality standards.
The instruction meets training requirements.
Equipment satisfies operational, training, and support requirements.
Facilities meet operational, training, and support requirements.

Period of formative evaluation

Planning for formative evaluation begins in the initial planning stage of ISD. However, formative evaluation activities actually begin during analysis and continue through small-group tryout in development.

Section B
Summative Evaluation

Introduction

With the conclusion of small-group tryouts, formative evaluation activities are complete. **Summative evaluation** is the next stage in the continuous evaluation process. This stage of evaluation involves trying out the instruction on the target audience in an operational environment. In some organizations, summative evaluations are conducted after the instructional system becomes operational and include two components: internal and external evaluation.

What it is

Summative evaluation is a form of evaluation designed to collect data and information during the operational (field) tryouts in order to determine the "summed" effect of the instruction under operational conditions and to make any changes or revisions to the system prior to becoming operational. Summative evaluations are also conducted when significant revisions or updates have been made to the instructional system.

Summative evaluation activity

The only summative evaluation activity is the operational tryouts. Operational tryouts are used to:

Determine if the training system works under operational conditions.
Provide feedback from a large sample of target audience in which to base revisions prior to implementation of the training system.
Identify possible implementation or operational problems.
Determine if training is cost-efficient.
Determine if training is adequate and needed.

Evaluating the integrated system

Summative evaluations are conducted on fully integrated training systems. This form of evaluation is essential in determining the effectiveness of the system and correcting any deficiencies prior to implementation.

Period of summative evaluation

Summative evaluation is focused on the period of operational tryouts. These tryouts begin after the small-group tryouts have been completed and continue until the training system is implemented. Normally, the operational tryout period is limited to two or three classes.

Section C
Operational Evaluation

Introduction

As previously mentioned, the evaluation process is continuous. Once the formative and summative evaluation activities have been completed and the training system is implemented, **operational evaluation** begins. Operational evaluation continues as long as the system is operational.

What it is

Operational evaluation is a form of evaluation designed to gather and analyze internal and external feedback data to ensure that the system continues to effectively and cost-efficiently produce graduates who meet established training requirements.

Operational evaluation activities

Operational evaluation includes the following activities.

Internal Evaluation

Internal evaluation focuses on evaluating the training system internally. This form of evaluation continuously evaluates feedback data such as instructor comments, student critiques, and test results in order to continually improve the system and ensure quality.

External Evaluation

External evaluation focuses on evaluating the training system externally. This form of evaluation continually evaluates feedback data from the field such as inspection and evaluation reports to ensure that graduates meet the established job performance requirements.

Relationship of activities

Each operational evaluation activity contributes to the overall quality of the training system by ensuring that:

Each system component continues to contribute to the overall effectiveness and cost-efficiency of the system.
Graduates of the course continue to meet the established job performance requirements.
Training is adequate and necessary.

Period of operational evaluation	Operational evaluation begins with the implementation of the training system and continues for the life cycle of the system.

RICHARD E. BROWN, Lt General, USAF
DCS/Personnel

ATTACHMENT 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

AFPD 36-22	Military Training
AFI 36-2201	Developing, Managing and Conducting Military Training
AFI 36-2301	Professional Military Education
AFMAN 36-2234	Instructional System Development
AFMAN 36-2236	Handbook for Air Force Instructors
AFH 36-2235	Information for Designers of Instructional Systems (12 Volumes)
Vol 1	ISD Executive Summary for Commanders and Managers
Vol 2	ISD Automated Tools/What Works
Vol 3	Application to Acquisition
Vol 4	Manager's Guide to New Education and Training Technologies
Vol 5	Advanced Distributed Learning: Instructional Technology and Distance Learning
Vol 6	Guide to Needs Assessment
Vol 7	Design Guide for Device-based Aircrew Training
Vol 8	Application to Aircrew Training
Vol 9	Application to Technical Training
Vol 10	Application to Education
Vol 11	Application to Unit Training
Vol 12	Test and Measurement Handbook

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ACRONYMS AND ABBREVIATIONS

AATS	Advanced Aircrew Training Systems
AETC	Air Education and Training Command
AETCR	Air Education Training Command Regulation
AF	Air Force
AFH	Air Force Handbook
AFI	Air Force Instruction
AFMAN	Air Force Manual
AFPD	Air Force Policy Directive
AFS	Air Force Specialty
AFSC	Air Force Specialty Code
AIS	Academic Instructor School
ARCS	Attention, Relevance, Confidence, and Satisfaction
ATI	Automated Training Indicator
CAI	Computer-Assisted Instruction
CBI	Computer-Based Instruction
CBT	Computer-Based Training
CC	Course Chart
CMI	Computer-Managed Instruction
CRT	Criterion-Referenced Test
CTS	Course Training Standard
DoD	Department of Defense
DT&E	Development Test and Evaluation
FMI	Functional Management Inspection
HQ USAF	Headquarters United States Air Force
ICW	Interactive Courseware
IG	Inspector General
ISD	Instructional System Development
IVD	Interactive Videodisc
LP	Lesson Plan

MAJCOM	Major Air Command
MCP	Military Construction Project
OJT	On-the-Job Training
OMSq	Occupational Measurement Squadron
OSR	Occupational Survey Report
OT&E	Operational Test and Evaluation
POI	Plan of Instruction
QAF	Quality Air Force
QI	Quality Improvement
SKA	Skill, Knowledge and Attitude
SME	Subject Matter Expert
SPO	System Program Office
STS	Specialty Training Standard
TC	Training Center
TDY	Temporary Duty
TER	Training Evaluation Report
TIC	Technical Instructor Course
TIMS	Training Information Management System
TNA	Training Needs Assessment
TO	Technical Order
TPR	Trained Personnel Requirement
TPT	Training Planning Team
TQR	Training Quality Report
TTMS	Technical Training Management System
U&TW	Utilization and Training Workshop
USAF	United States Air Force
VCR	Video Cassette Recorder
WRM	War-Readiness Material

TERMS

The following list of definitions includes those terms commonly used in technical training as it relates to instructional system development and as used in this handbook. The list is not to be considered all-inclusive.

Association. The connection made between an input (stimulus) and an action (response).

Attitude. (a) The emotions or feelings that influence a learner's desire or choice to perform a particular task. (b) A positive alteration in personal and professional beliefs, values, and feelings that will enable the learner to use skills and knowledge to implement positive change in the work environment. Also see **Knowledge** and **Skill.**

Behavior. Any activity, overt or covert, capable of being measured.

Cognition. The mental or intellectual activity or process of knowing, including both awareness and judgment.

Cognitive Strategies. The capability of individuals to govern their own learning, remembering, and thinking behavior.

Computer-Assisted Instruction (CAI). The use of computers to aid in the delivery of instruction. A variety of interactive instructional modes are used including tutorial, drill, practice, gaming, simulation, or combinations. CAI is an integral part of computer-based instruction (CBI) and computer-based training (CBT).

Computer-Based Instruction (CBI) and Computer-Based Training (CBT). The use of computers to aid in the delivery and management of instruction. CBI and CBT are synonymous and are used interchangeably. CAI (the delivery of instruction) and CMI (computer-managed instruction) are both elements of CBI and CBT.

Computer-Managed Instruction (CMI). The use of computers to manage the instructional process in CAI or CBT. Management normally includes functions such as registration, pretesting, diagnostic counseling, progress testing, and post-testing. CMI is also used to schedule and manage training resources such as trainers and actual equipment.

Constraints. Limiting or constraining conditions or factors, such as policy considerations, time limitations, equipment, environmental factors, personnel, budgetary, or other resource limitations.

Course Chart. A qualitative course control document that states the course identity, length, and security classification, lists major items of training equipment, and summarizes the subject matter covered.

Course Control Documents. Specialized publications used to control the quality of the instructional system. Examples are training standards, plans of instruction, syllabi, and course charts.

Courseware. Training materials such as technical data, textual materials, audiovisual instructional materials, computer-based instructional materials.

Criterion. (a) The standard by which something is measured. (b) In test validation, the standard against which test instruments are correlated to indicate that accuracy with which they predict human performance in some specified area. (c) In evaluation, the measure used to determine the adequacy of a product, process, behavior, and other conditions.

Criterion-Referenced Test (CRT). A test to determine, as objectively as possible, a student's achievement in relation to a standard based on criterion objectives. During instructional development, the CRT can be used to measure the effectiveness of the instructional system. The test may involve multiple-choice items, fill-in items, essays, or actual performance of a task. If given immediately after the learning sequence, it is an acquisition test; if given considerably later, it is a retention test; if it requires performance not specifically learned during instruction, it is a transfer test.

Discrimination. The process of making different responses to a stimulus. A discrimination requires a person to determine the differences among inputs and to respond differently to each.

Distance Learning. Training that is exported, such as from a resident course to a field location. Also called **Exportable Training.**

Duty. A large segment of the work done by an individual; major divisions of work in a job.

Evaluation. A judgment expressed as a measure or ranking of trainee achievement, instructor performance, process, application, training material, and other factors (see DoD Inst. 29612). It includes Formative **Evaluation**, **Operational Evaluation** and **Summative Evaluation**.

Exportable Training. See **Distance Learning.**

External Evaluation. The acquisition and analysis of feedback data from outside the formal training environment to evaluate the graduate of the instructional system in an operational environment. Also called **Field Evaluation.** Also see **Operational Evaluation.**

Feedback. Information that results from or is contingent upon an action. The feedback does not necessarily indicate the rightness of an action; rather, it relates the results of the action from which inferences about correctness can be drawn. Feedback may be

immediate, as when a fuse blows because a lamp is incorrectly wired; or delayed, as when an instructor provides a discussion pertaining to an exam taken the previous week, or when completed graduate evaluation questionnaires are reviewed.

Fidelity. The degree to which a task or a training device represents the actual system performance, characteristics, and environment.

Field Evaluation. See **External Evaluation.**

Formative Evaluation. An activity that provides information about the effectiveness of training materials to meet training objectives and the trainees' acceptance of training materials as they are being developed. It is conducted while the instructional system or course is still under development, to gather data on lessons, units, or modules of instruction as they are completed. The purpose is make improvements to the system or course while development is still in progress. Also see **Evaluation.**

Generalization. Learning to respond to a new stimulus that is similar, but not identical, to one that was present during original learning. For example, during learning a child calls a beagle and spaniel by the term "dog"; a child who has generalized would respond "dog" when presented with a hound.

Instructional Objective. See **Objective.**

Instructional System. An integrated combination of resources (students, instructors, materials, equipment, and facilities), techniques, and procedures performing effectively and efficiently the functions required to achieve specified learning objectives.

Instructional System Developer. A person who is knowledgeable of the instructional system development (ISD) process and is involved in the analysis, design, development, implementation, and evaluation of instructional systems. Also called Instructional Designer, Instructional Developer, Curriculum Developer, Curriculum Development Manager, and other terms.

Instructional System Development (ISD). A deliberate and orderly, but flexible, process for planning, developing, implementing, and managing instructional systems. ISD ensures that personnel are taught in a cost-efficient manner the skills, knowledge, and attitudes essential for successful job performance.

Interactive Courseware (ICW). Computer-controlled training designed to allow the student to interact with the learning environment through input devices such as keyboards and light pens. The student's decisions and inputs to the computer determine the level, order, and pace of instructional delivery, and forms of visual and aural outputs.

Interactive Videodisc (IVD). A form of ICW instruction that specifically makes use of videodisc technology. Video and audio signals are pressed onto the laser videodisc; programming codes may or may not be pressed onto the disc depending on the IVD

level. As a result, motion sequence, still-frame shots, computer-generated graphics, and/or audio may be displayed and heard through a monitor under computer and user control.

Internal Evaluation. The acquisition and analysis of feedback and management data from within the formal training environment to assess the effectiveness of the instructional system. Also see **Operational Evaluation.**

Job. The duties, tasks, and subtask elements performed by an individual. The job is the basic unit used in carrying out the personnel actions of selection, training, classification, and assignment.

Job Aid. A checklist, procedural guide, decision table, worksheet, algorithm, or other device used by the worker to aid in task performance. Job aids reduce the amount of information that personnel must recall or retain.

Job Analysis. The basic method used to obtain salient facts about a job, involving observation of workers, conversations with those who know the job, analysis questionnaires completed by job incumbents, or study of documents involved in performance of the job.

Job Performance Requirements (JPR). The tasks required of the human component of the system, the conditions under which these tasks must be performed, and the quality standards for acceptable performance. JPRs describe what people must do to perform their jobs.

Knowledge. Use of the mental processes that enable a person to recall facts, identify concepts, apply rules or principles, solve problems, and think creatively. Knowledge is not directly observable. A person manifests knowledge through performing associated overt activities. Also see **Attitude** and **Skill.**
Learning. A change in the behavior of the learner as a result of experience. The behavior can be physical and overt, or it can be intellectual or attitudinal.

Lesson Plan. An approved plan for instruction that provides specific definition and direction to the instructor on learning objectives, equipment, instructional media material requirements, and conduct of training. Lesson plans are the principal component of curriculum materials in that they sequence the presentation of learning experiences and program the use of supporting instructional material.

Media. The delivery vehicle for presenting instructional material or basic communication stimuli to a student to induce learning. Examples are instructors, textbooks, slides, and interactive courseware (ICW).

Metrics. Measurement tools used for assessing the qualitative and quantitative progress of instructional development with respect to the development standards specified.

Motor Skill. Physical actions required to perform a specific task. All skills require some type of action.

Norm-Referenced Test. The process of determining a student's achievement in relation to other students. Grading "on the curve" involves norm-referenced measurement since an individual's position
on the curve (grade) depends on the performance of other students. Generally, norm-referenced measurement is not appropriate in the Air Force ISD process.

Objective. A statement that specifies precisely what behavior is to be exhibited, the conditions under which behavior will be accomplished, and the minimum standard of performance. Objectives describe only the behaviors that directly lead to or specifically satisfy a job performance requirement. An objective is a statement of instructional intent.

Operational Evaluation. The process of internal and external review of operational training systems. It is designed to gather and analyze internal and external feedback data to ensure that the system continues to effectively and cost-efficiently produce graduates who meet established training requirements. It includes **Internal Evaluation** and **External Evaluation.** Also see **Evaluation.**

Perceptual Skill. The process of information extraction; the process by which an individual receives or extracts information from the environment through experiences and assimilates this data as facts (sight, sound, feel, taste, smell).

Performance. Part of a criterion objective that describes the observable student behavior (or the product of that behavior) that is acceptable to the instructor as proof that learning has occurred.

Plan of Instruction (POI). A qualitative course control document designed for use primarily within a school for course planning, organization, and operation. Generally, criterion objectives, duration of instruction, support materials, and guidance factors are listed for every block of instruction within a course. Also called **Syllabus.**

Posttest. A criterion-referenced test designed to measure performance on objectives taught during a unit of instruction; given after the training.

Pretest. A criterion-referenced test designed to measure performance on objectives to be taught during a unit of instruction and performance on entry behavior; given before instruction begins.

Reliability. (a) A characteristic of evaluation which requires that testing instruments yield consistent results. (b) The degree to which a test instrument can be expected to yield the same result upon repeated administration to the same population. (c) The capability of a device, equipment, or system to operate effectively for a period of time without a failure or breakdown.

Sampling Test. A test that measures knowledge objectives and knowledge components of performance objectives in sufficient quantity to provide an acceptable degree of confidence that the students have attained the required knowledge.

Skill. The ability to perform a job-related activity that contributes to the effective performance of a task. Skills involve physical or manipulative activities that often require knowledge for their execution. All skills are actions having specific requirements for speed, accuracy, or coordination. Also see **Attitude** and **Knowledge.**

Subject Matter Expert (SME). (a) An individual who has thorough knowledge of a job, duties/tasks, or a particular topic, which qualifies him/her to assist in the training development process (for example, to consult, review, analyze, advise, or critique). (b) A person who has high-level knowledge and skill in the performance of a job.

Summative Evaluation. The overall assessment of a program at the completion of the developmental process. It is designed and used after the instructional system has become operational. Data gathered during this form of evaluation is used to determine the effectiveness of the instructional system. It identifies how well the system is working – that is, how well graduates can meet job performance requirements. Also see **Evaluation.**

Syllabus. See **Plan of Instruction.**

System Approach to Training (SAT). Procedures used by instructional system developers to develop instruction. Each phase requires input from the prior phase and provides input to the next phase. Evaluation provides feedback that is used to revise instruction. Also see **Instructional System Development.**

Target Audience. The total collection of possible users of a given instructional system. The persons for whom the instructional system is designed.

Task. A unit of work activity or operation which forms a significant part of a duty. A task usually has clear beginning and ending points and directly observable or otherwise measurable processes, frequently but not always resulting in a product that can be evaluated for quantity, quality, accuracy, or fitness in the work environment. A task is performed for its own sake; that is, it is not dependent upon other tasks, although it may fall in a sequence with other tasks in a duty or job array.

Task Analysis. The process of describing job tasks in terms of Job Performance Requirements (JPR) and the process of analyzing these JPRs to determine training requirements. Also see **Job Performance Requirements.**

Terminal Objective. An objective the learner is expected to accomplish upon completion of the instruction. It is made up of enabling (support or subordinate) objectives.

Training. A set of events or activities presented in a structured or planned manner, through one or more media, for the attainment and retention of skills, knowledge, and attitudes required to meet job performance requirements.

Training Needs Assessment (TNA). The study of performance and the environment that influences it in order to make recommendations and decisions on how to close the gap between the desired performance and the actual performance.

Training Planning Team. An action group composed of representatives from all pertinent functional areas, disciplines, and interests involved in the life cycle design, development, acquisition, support, modification, funding and management of a specific defense training system.

Training Strategy. An overall plan of activities to achieve an instructional goal.

Training System. A systematically developed curriculum including, but not necessarily limited to, courseware, classroom aids, training simulators and devices, operational equipment, embedded training capability, and personnel to operate, maintain, or employ a system. The training system includes all necessary elements of logistic support.

Utilization and Training Workshop. A forum to determine Specialty Training Standard requirements and responsibilities for the specialty. Workshop attendees include, but are not limited to, representatives from the training and using organizations.

Validation. The process of developmental testing, field testing, and revision of the instruction to be certain the instructional intent is achieved. The instructional system is developed unit by unit and tested (or validated) on the basis of the objective prepared for each unit. Validation allows instructional designers to guarantee specific results.

Validity. The degree to which a criterion test actually measures what it is intended to measure.